



# 12d® International Innovation Awards

## Executive Summary

**Name:** Samuel Cech  
**Company:** Eliot Sinclair & Partners  
**Name of Project:** Level Book Macro  
**Awards Result:** First Place (Tied)

Eliot Sinclair and Partners was involved with Precise Monitoring Surveys of areas affected by the September 2010 Canterbury Earthquake.

A solution was developed using the inbuilt 12d Model macro language. Precise level run surveys were carried out by multiple field parties utilising different equipment including both Leica and Trimble.

Eliot Sinclair & Partners was able to devise a procedure to quality control each set of observations, identify potential errors in level runs and produce adequate quality assurance documents.

Traditional methods of Level Book run processing resulted in multiple RL values for marks that have been observed in different runs. This macro automates adjustments so they can be processed quickly between earthquake events.





# 12d® International Innovation Awards

## Entry Form

Please email your completed entry to [innovation@12d.com](mailto:innovation@12d.com)

Name:	Samuel Cech
Position:	Technical Manager
Company:	Eliot Sinclair and Partners Ltd.
Name of Project:	Level Book Macro
Client:	Eliot Sinclair and Partners Ltd.

### Description of Project:

- The Company has been involved in Precise Monitoring Surveys of areas affected by the September 2010 Canterbury Earthquake. Various clients have engaged the company on many on-going monitoring projects in the past 18 months.
- This entry is specific to Precise Level monitoring surveys of large networks of vertical monitoring marks.

### Description of problem faced / task undertaken:

- Precise level run surveys were carried out by multiple field parties utilising different equipment. It became apparent that adjusting this level network will require some out of the box thinking, bringing all data together into one survey package adjusting by traditional rise/fall methods as well as Least Squares techniques. However, all existing methods of processing either lacked in their abilities to QC each set of observations, identify potential errors in level runs and produce adequate QA documents. Traditional methods of Level Book run processing resulted in multiple RL values for marks that have been observed in different runs. Manual adjustments took too long to process between earthquake events. We needed:
  - 1) faster semi-automated method of reducing, adjusting and verifying network of level runs
  - 2) independent method of adjustment
  - 3) better QC processes to identify individual runs with possible errors
  - 4) better QA reporting to demonstrate results and accuracies
  - 5) enable traditional rise and fall level book methods to be utilised
  - 6) enable support for data input by direct entry as well as import of digital Leica and Trimble files

Do more with your software



**12d® Model**  
CIVIL AND SURVEYING SOFTWARE

Fast. Flexible. Comprehensive.

[www.12d.com](http://www.12d.com)

**exds**  
[exds.com.au](http://exds.com.au)



12d® Model  
Conference  
2012  
INTERNATIONAL SURVEY CONFERENCE

# 12d® International Innovation Awards

## How the problem was solved:

- We have created a Macro that:
  - imports Leica GSI and Trimble M5 precise level files or csv spreadsheet generated by this macro
  - allows for error distribution by weight either by observed distance or number of observations.
  - multiple level run blocks are adjusted within the same spreadsheet
  - dynamically update benchmark values across all blocks
  - update z-value of control points within a Model
  - generate LIN file for independent adjustment by Least Squares
  - generate HTML report
  - generate CSV file for backup purposes and to be able to edit the data in the spreadsheet
  - generate IDZ file listing of final adjusted values for all marks
- Documented a process for reductions and checks within 12d Model:
  - import digital precise level file
  - calculate misclose for each individual block
  - identify any runs that need to be repeated or removed from adjustment due to errors
  - export the entire network to Survey =>Adjustments =>Level network \*.LIN file (LSQ option) for further processing
  - use the results from the LSQ option to update benchmark values within the Level Book macro
  - adjust the level book and compare results between LSQ and Level book macro

## Relevant 12d screenshots and/or data attached:

- Example Level Book Report.pdf
- Example Least Squares Adjustment.pdf
- HELP\_Level\_line\_run.pdf
- Level\_line\_run\_Macro.zip

Do more with your software



**12d® Model**  
CIVIL AND SURVEYING SOFTWARE

Fast. Flexible. Comprehensive.

[www.12d.com](http://www.12d.com)

**eXds**  
[exds.com.au](http://exds.com.au)