

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

DG023 The use of Pipe Damage Assessment Tool (PDAT) outputs for Project Definition and Concept Design

Story: Pipe Damage Assessment Tool (PDAT)

Theme: Design

A design guideline which provides guidance to project definition and design teams on how to use Pipe Damage Assessment Tool (PDAT) outputs in their scoping and concept design work.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz



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DESIGNERS GUIDELINE

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| <input type="checkbox"/> Structures | <input type="checkbox"/> Roading | <input type="checkbox"/> Water Reticulation |

Subject: **The use of Pipe Damage Assessment Tool (PDAT) outputs for Project Definition and Concept Design**

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Updated by: David Heiler (24/6/13)

Updates were:

- Changes resulting from the migration of the PDAT to a GIS platform

Keywords:

Wastewater, stormwater, asset assessment, CCTV

1. Purpose of guideline

To provide guidance to project definition and design teams on how to use PDAT outputs in their scoping and concept design work.

2. Background

The Pipe Damage Assessment Tool (PDAT) has been developed by Asset Assessment and GIS teams at SCIRT to assist in gravity pipe structural condition assessment.

The PDAT predicts the structural condition of all individual pipe assets that have not been CCTV'd based on what CCTV has been completed and by looking at damage indicators such as pipe depth, material, diameter, direction, local RAMM data, LRI, proximity to waterways, and subcatchment area.

Predictions are made for each pipe asset in terms of Renewal, Repair and No Action.

The PDAT has recently been migrated from a spreadsheet model to SCIRT GIS. Running the PDAT within SCIRT GIS will allow for more regular (weekly) updates as assets are introduced to the network, it makes PDAT assessments available to designers through the GIS viewer, and incorporates a process for regular updating of the assessment with new CCTV data.

The PDAT was primarily developed to reduce our reliance on CCTV and to reduce the CCTV spend. PDAT assessments can be used to:

- Predict the structural condition of pipes that we have no CCTV for.
- Predict the structural condition of pipes that can't be practically CCTV'd due to high flows or access issues.
- Assess damage in low and high damage areas to reduce the amount of CCTV required to inform the rebuild.

Separate PDATs have been developed for the WW and SW networks. The PDAT runs through SCIRT Rebuild Catchments individually using a feature manipulation engine (FME) in GIS before collating and presenting results for the entire network.

The PDAT chooses the best set of damage indicators for each Rebuild Catchment studied and the combinations of damage indicators are specific to each Rebuild Catchment studied.

3. Recommendation

It is recommended that PDAT outputs are used by project definition and design teams to inform project scoping and concept design. This will reduce the amount of field investigation required before this work is completed and provide better focus to CCTV requests where they are required to inform the detailed design.

The PDAT will be run on a weekly basis with the outputs published to SCIRT GIS and back into InfoNet. Changes in the base network (mostly due to the discovery of unknown SW assets) will be captured each week. Latest CCTV assessments from InfoNet will also be used in the weekly update.

PDAT assessments will only be published where no current CCTV or Pole Cam assessment exists. Within GIS PDAT assessments are found under:

For WW: Condition Assessment > Ww Assessments > WW PDA Assessment
For SW: Condition Assessment > Sw Assessments > SW PDA Assessment

The following fields will be displayed for each pipe asset in GIS:

1. Standard asset fields taken directly from GIS data. These are: Pipe ID, Diameter, Material, Year Laid, Assessment (NO ACTION, REPAIR, RENEWAL), Length.
2. PDAT specific fields:
 - a. Date Assessed – this is the date that the PDAT was run
 - b. Pipe Confidence – this is the probability (out of 1) for the selected assessment. PDAT provides probabilities for each of the assessment choices (summing to 1) and selects the assessment with the highest probability. A high (close to 1) probability indicates that there is strong confidence in the PDAT selection for that pipe.
 - c. Fault Estimate – an estimate of the number of faults if selected where Repair is selected by PDAT. The Fault Estimate is the average number of faults recorded within the Rebuild Catchment for pipes that have been assessed as requiring Repair through CCTV.
 - d. Rebuild Catchment – this is the SCIRT Rebuild Catchment. The location of these shown on SCIRT GIS under: SCIRT Projects > Rebuild Catchments
 - e. Catchment Confidence – this indicates what confidence we have in the PDAT within this Rebuild Catchment (out of 1). It compares the PDAT assessment with CCTV assessments (where these are available) and computes the Catchment Confidence as:
 - $Catchment\ Confidence = (N^{\circ}\ correct\ predictions) / (Total\ N^{\circ}\ predictions)$
 - f. CCTV Completion – this is the percentage of pipes within the rebuild Catchment that CCTV assessments are available for (proportion, expressed out of 1).

Designers can capture PDAT outputs for pipes within their project area or rebuild catchment by undertaking the following steps on the SCIRT GIS viewer:

Option 1: Use Condition Assessment Search to search by pipe ID or Rebuild Catchment

For each of the WW and SW, there are three search types available.

- a single pipe ID,
- by multiple pipe IDs
- by rebuild catchment.

Option 2: Use Advanced Search to search by SCIRT project number and then by location

First select the project then use the advanced search “Search by location” tool, to find all PDA assessments within the project boundary.

Refer to user guide on viewer for more detailed instructions on using the Search and Advanced Search.