Deltares

DAM UI

Technical Design

DAM UI

Technical Design

Authors
Tom The, John Bokma

Partners
-

\coverPhoto{...}

DAM UI

Technical Design

Client	Deltares - Geo engineering DKS
Contact	tom.the@deltares.nl, john.bokma@deltares.nl
Reference	1210702-000-GEO-0009
Keywords	Dike, safety assessment, design, software, macro stability, piping

Document control

Version	0.2
Date	April 2022
Project number	1210702-000
Document ID	-
Pages	19
Status	draft This is a draft report, intended for discussion purposes only. No part of this report may be relied upon by either principals or third parties.

Author(s)

	Tom The	Deltares
	Tom The, John Bokma	

Summary

This document contains the technical design for DAM UI, an application that computes the strength of a complete dikering with respect to several failure mechnanisms, such as macro stability and piping.

Samenvatting

Dit document bevat het technisch ontwerp voor DAM UI, een User Interface applicatie die een gebruiker in staat stelt om voor een dijktraject berekeningen uit te voeren voor verschillende faalmechanismen, waaronder macrostabiliteit en piping.

Contents

Summary 4

List of Tables 6

List of Figures 7

List of To Do's 8

1 Introduction 9
1.1 Purpose and scope of this document 9
1.2 Other system documents 9

2 System Architecture 10
2.1 DAM components 10
2.2 DAM UI components 10
2.3 DAM UI Dataflow 11

3 Architectural Choices 13

4 Data Model 14

5 Data Description 15
5.1 Input 15
5.1.1 Sigma Tau Curves 15
5.1.2 Su Tables 15
5.2 Results 15

6 Module Description 17

7 Literature 18

List of Tables

1.1 DAM UI system documents. 9

List of Figures

2.1	DAM and its components.	10
2.2	DAM UI components.	11
2.3	DAM UI Dataflow.	12
4.1	DAM UI UI Data Model.	14

List of To Do's

3.1	Architectural Choices	13
5.1	Data Description Input	15
6.1	Module Description	17

1 Introduction

1.1 Purpose and scope of this document

This document contains the technical design for the standalone program DAM UI, a software package for the automated calculation of the strength of dikes. DAM was developed by Deltares with and for STOWA for all water authorities.

1.2 Other system documents

The full documentation on the program comprises the following documents.

Title	Content
Functional Design (Van der Zwan and Bokma, 2022)	Description of the requirements and functional design of DAM UI.
Technical Design (this document) (The and Bokma, 2022)	Description of the technical design of DAM UI.
Technical documentation (Doxygen, 2017)	Description of the arguments and usage of different software components, generated from in-line comment with Doxygen.
Test Plan (Trompille, 2017a)	Description of the different regression and acceptation tests, including target values, of DAM UI.
Test Report (Trompille, 2017b)	Description of the test results (benchmarks and test scripts),of DAM UI.
User Manual (Erik Vastenburg, 2013)	Description of the different functionalites available in the *User Interface* and background information.

Table 1.1 DAM UI system documents.

2 System Architecture

2.1 DAM components

DAM UI is part of the whole DAM system that contains several components. Please see Figure 2.1 for an overview of the components of DAM. In (The, 2017) a description of the overall architecture of the DAM system can be found.

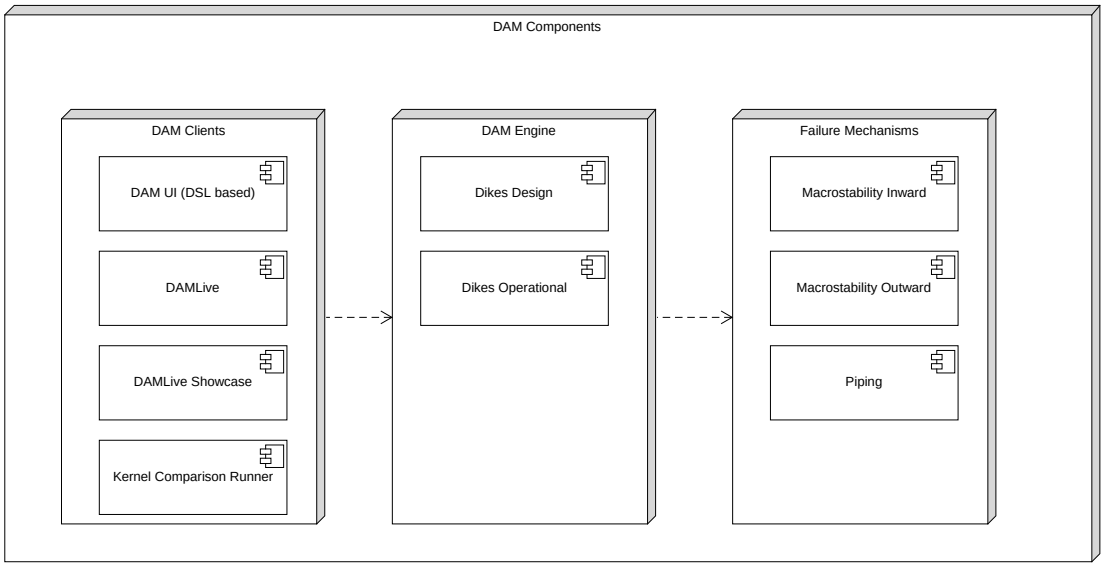

Figure 2.1 DAM and its components.

The arrows illustrate the dependencies of the components.

2.2 DAM UI components

See Figure 2.2 for an overview of the components of DAM UI .

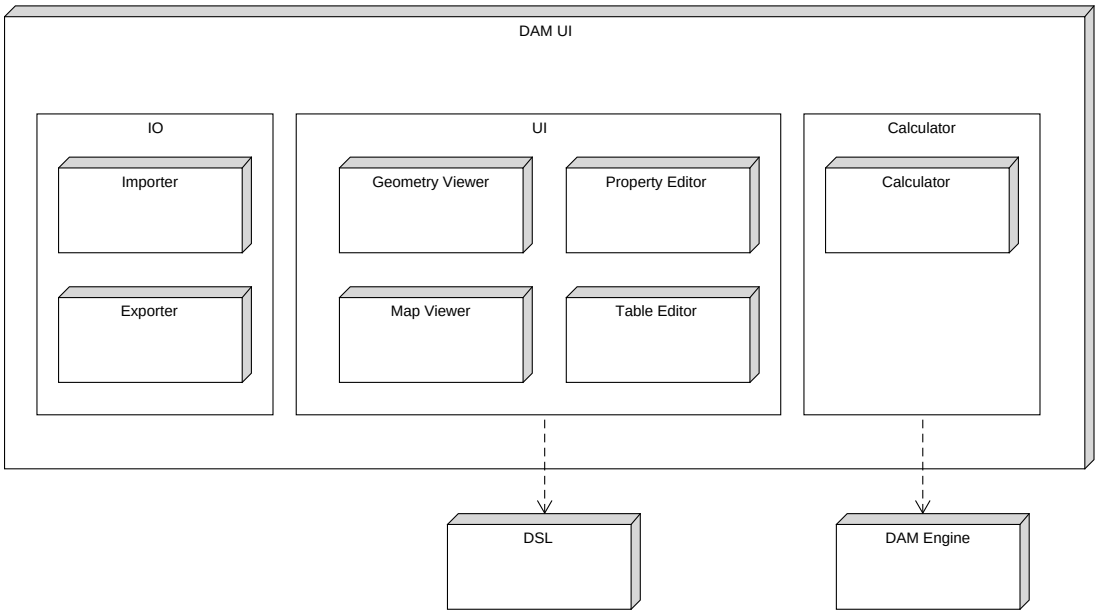

Figure 2.2 DAM UI components.

2.3 DAM UI Dataflow

See Figure 2.3 for an overview of the dataflow in DAM UI .

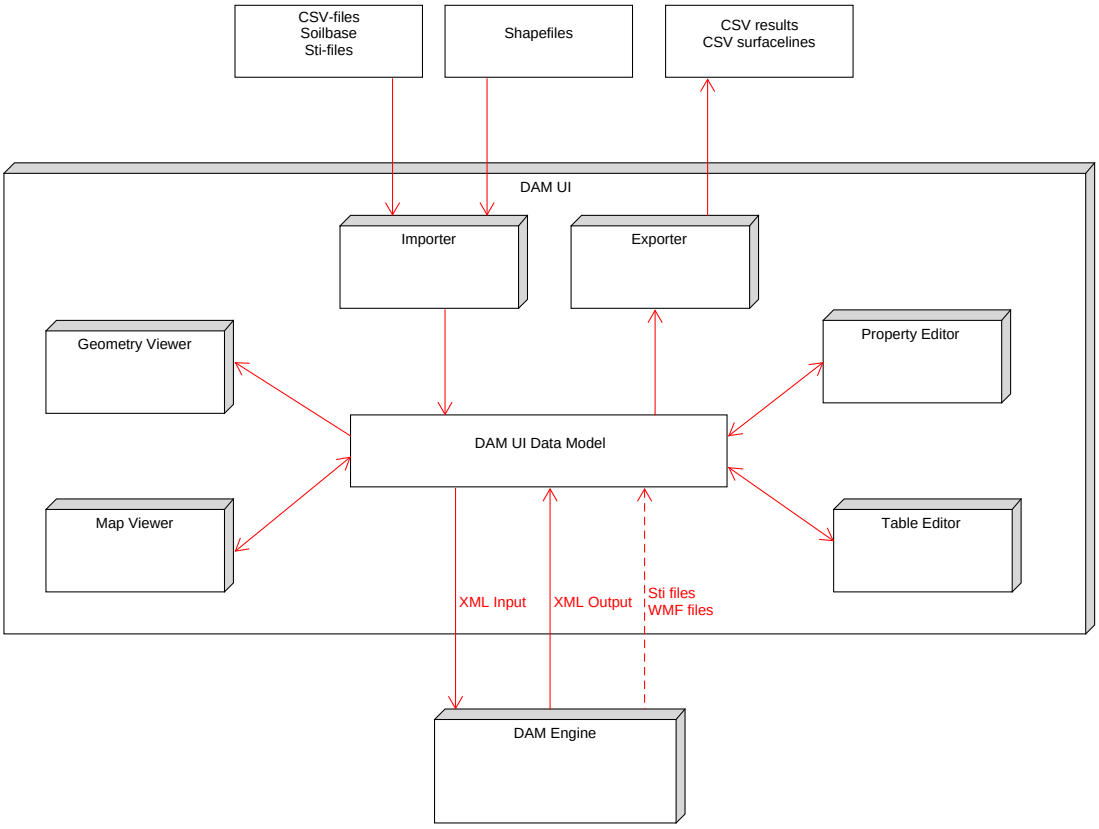

Figure 2.3 DAM UI Dataflow.

In case the DAM Engine is used to calculate the macro stability, additional output is available in the form of an output file per calculation. This file (.stix) holds the resulting slip plan besides to the input and can be used to review the result using D-Stability. The input files can be used to check/redo the calculation using the UI suitable for the used kernel.

The required input is specified via the MacroStabilityInput object as defined in the C # wrapper module for the Macro Stability kernel. In the communication between Engine and UI, the name of the resulting stix file is part of the Design Results of the XML output of the Engine. This name of course has to unique and will be created based on the names of the location, scenario and profile combined with the number of the iteration in case of design. To indicate its purpose, it ends on "_result".

Future developments foreseen for the stability calculations include the addition of the bare input for the Macro Stability kernel in order to be able to check the position of the input grid(s).

3 Architectural Choices

TODO 3.1 *Architectural Choices* ***TODO***

4 Data Model

See Figure 4.1 for an overview of the data model of DAM UI .

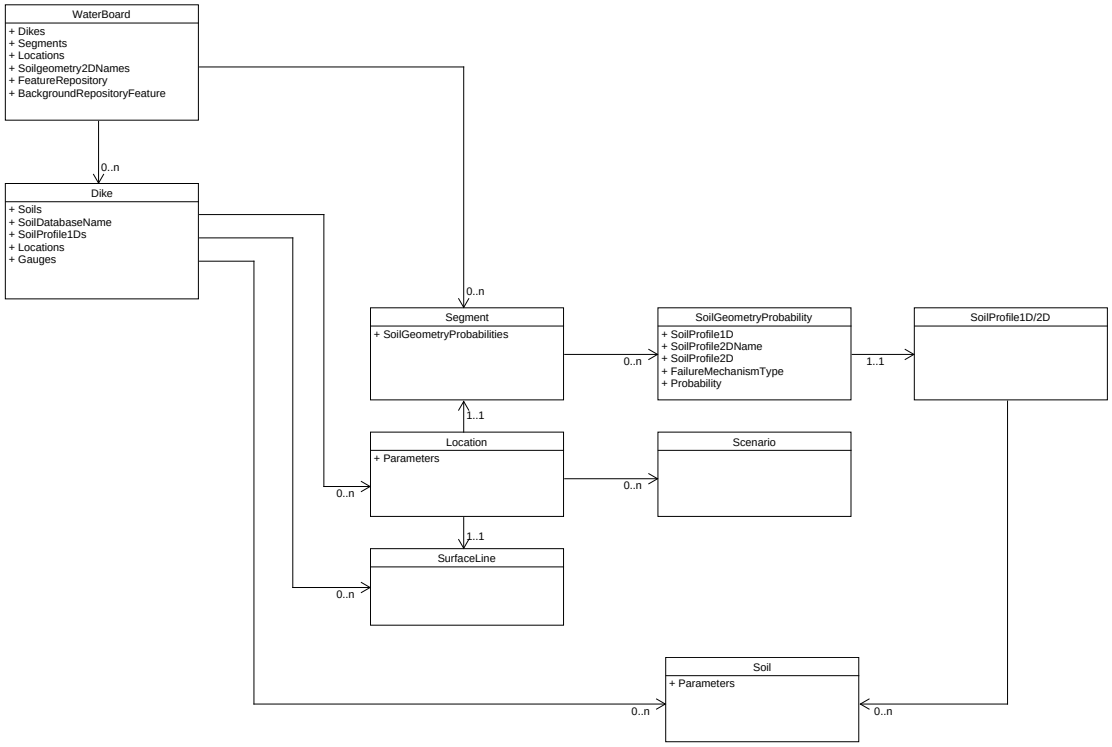

Figure 4.1 DAM UI UI Data Model.

5 Data Description

5.1 Input

5.1.1 Sigma Tau Curves

TODO 5.1 Data Description Input **TODO**

As part of the soil parameters, sigma tau curves can be used to determine the shear strength in stability calculations. A full description of the used method can be found in (Brinkman *et al.*, 2022).

In order to use sigma tau curves in DAM, the name(s) of the curve(s) to be used must be added to the *soils.csv* at column *sigma_tau_curve_name* and the proper shear strength model (*SigmaTauCurve*) must be selected for that soil. Next to that, the sigma tau curves must be defined in their own csv-file (*sigmataucurves.csv*). Both csv files use the *sigma_tau_curve_name* to couple the data.

For more information, see DAM UI User manual.

5.1.2 Su Tables

As part of the soil parameters, su tables can be used to determine the undrained shear strength in stability calculations. A full description of the used method can be found in (Brinkman *et al.*, 2022).

In order to use su tables in DAM, the name(s) of the table(s) to be used must be added to the *soils.csv* at column *su_table_name* and the proper shear strength model (*SuTable*) must be selected for that soil. Next to that, the su tables must be defined in their own csv-file (*sutables.csv*). Both csv files use the *su_table_name* to couple the data.

For more information, see DAM UI User manual.

5.2 Results

First of all, not all calculations will pass kernel validations or lead to valid results due to errors that occur in the calculations (e.g. uplift does not occur where it is expected). Some calculations may be performed but cause warnings. Using a log manager, all these cases are reported back to the user via a log that is to be displayed at the end of the calculation process. This log is then also saved automatically with a time stamp. Note that the saved log will not be loaded again in the program itself. Finally, the log is cleared at the start of each new calculation process.

The results of the calculations differ per failure mechanism per model. An overview of all "single" result parameters is provided by the DAM documentation on the public wiki for DAM (https://publicwiki.deltares.nl/display/DAM/Tabblad+Ontwerpberekeningen). These results are presented in a table for all performed calculations.

Per individual calculation, a property editor provides access to the most important "single" result parameters. This editor also provided the opportunity for a user to evaluate the calculation and to add notes on it. This editor may also provide other options such as direct access to external programs to view and recalculate results.

This depends on the Failure mechanism and the model. For the failure mechanism stability, all relevant data (input and output) is available as stix file to enable starting D-Stability of the D-Geo Suite. This functionality is made available at the push of a button in the editor.

Next to these results parameters, other more complex result data is available for presentation and/or use too.

For the failure mechanism stability, output data is available for the resulting slip plane. This data is used to display that slip plane graphically within DAM UI itself. This slip plane is super imposed on the existing geometry as shown in the cross section tab.

For failure mechanisms piping, in case of design with the "Adapt geometry" option, a resulting surface line is available together with its (1D) profile. This data is written to a separate xml file per calculation with a proper identifiable name which is unique to the individual calculation. This name is comprised of location name, profile name, scenario name and if need be the iteration number. For the selected individual result, this adapted surface line is shown as dotted line within DAM UI super imposed on the existing geometry as shown in the cross section tab. For this, upon selection of an individual calculation result, the file with the data is read and the resulting surface line is drawn.

6 Module Description

TODO 6.1 *Module Description* ***TODO***

7 Literature

Brinkman, R., J. Nuttall and V. Trompille, 2022. *Macrostability kernel - Functional Design*. Tech. Rep. 11208059-002, version 2, final, Deltares.

Doxygen, 2017. *DAM UI - Technical documentation, Generated by Doxygen 1.8.10*. Tech. rep., Deltares.

Erik Vastenburg, I. v. Z., 2013. *DAM UI - Users Manual*. Tech. Rep. 1207094-000-GEO-0002, Versie 2, 11 juni 2013, concept, Deltares.

The, T., 2017. *DAM Architecture Overall*. Tech. Rep. 1210702-000-GEO-0005, version 0.1, jan. 2017, concept, Deltares.

The, T. and J. Bokma, 2022. *DAM UI - Technical Design*. Tech. Rep. 1210702-000-GEO-0009, version 0.2, april 2022, concept, Deltares.

Trompille, V., 2017a. *DAM UI - Test Plan*. Tech. Rep. 1210702-000-GEO-0010, version 0.1, jan. 2017, concept, Deltares.

Trompille, V., 2017b. *DAM UI - Test Report*. Tech. Rep. 1210702-000-GEO-0011, version 0.1, jan. 2017, concept, Deltares.

Zwan, I. van der and J. Bokma, 2022. *DAM UI - Functional design*. Tech. Rep. 1207094-000-GEO-0005, Versie 0.2, april 2022, concept, Deltares.

Deltares is an independent institute for applied research in the field of water and subsurface. Throughout the world, we work on smart solutions for people, environment and society.

Deltares

www.deltares.nl