Software Requirements Specification
MTOBridge

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Contents

1 Project Drivers **1**
- 1.1 The Purpose of the Project . . . 1
- 1.2 The Stakeholders . . . 1
  - 1.2.1 The Client . . . 1
  - 1.2.2 The Customers . . . 1
  - 1.2.3 Other Stakeholders . . . 1
- 1.3 Mandated Constraints . . . 1
- 1.4 Naming Conventions and Terminology . . . 1
- 1.5 Relevant Facts and Assumptions . . . 1

2 Functional Requirements **3**
- 2.1 The Scope of the Work and the Product . . . 3
  - 2.1.1 The Context of the Work . . . 3
  - 2.1.2 Work Partitioning . . . 4
  - 2.1.3 Individual Product Use Cases . . . 4
- 2.2 Functional Requirements . . . 5

3 Non-functional Requirements **9**
- 3.1 Look and Feel Requirements . . . 9
- 3.2 Usability and Humanity Requirements . . . 10
- 3.3 Performance Requirements . . . 11
- 3.4 Operational and Environmental Requirements . . . 12
- 3.5 Maintainability and Support Requirements . . . 12
- 3.6 Security Requirements . . . 12
- 3.7 Cultural Requirements . . . 13
- 3.8 Legal Requirements . . . 13
- 3.9 Health and Safety Requirements . . . 13

4 Project Issues **13**
- 4.1 Open Issues . . . 13
- 4.2 Off-the-Shelf Solutions . . . 13
- 4.3 New Problems . . . 14
- 4.4 Tasks . . . 14
- 4.5 Migration to the New Product . . . 14
- 4.6 Risks . . . 14
- 4.7 Costs . . . 14

4.8 User Documentation and Training 14
4.9 Waiting Room 14
4.10 Ideas for Solutions 14

5 Appendix **15**
5.1 Symbolic Parameters 15
5.2 Reflection 15

Table 1: Revision History

Date	**Developer(s)**	**Change**
October 4	David	Add context/partitioning of work
October 4	Daren	Added some Non-functional Requirements
October 4	Victor	Project Issues
October 5	Victor	Added some Non-functional Requirements
October 5	Pedram	Added Individual Product Usecase

List of Tables

1 Revision History iii
2 Business Event List 4

List of Figures

1 Context Diagram of MTOBridge 3

This document describes the requirements for MTOBridge. The template for the Software Requirements Specification (SRS) is a subset of the Volere template **?**. If you make further modifications to the template, you should explicitly state what modifications were made.

1 Project Drivers

1.1 The Purpose of the Project

1.2 The Stakeholders

1.2.1 The Client

1.2.2 The Customers

1.2.3 Other Stakeholders

1.3 Mandated Constraints

1.4 Naming Conventions and Terminology

1.5 Relevant Facts and Assumptions

User characteristics should go under assumptions.

2 Functional Requirements

2.1 The Scope of the Work and the Product

2.1.1 The Context of the Work

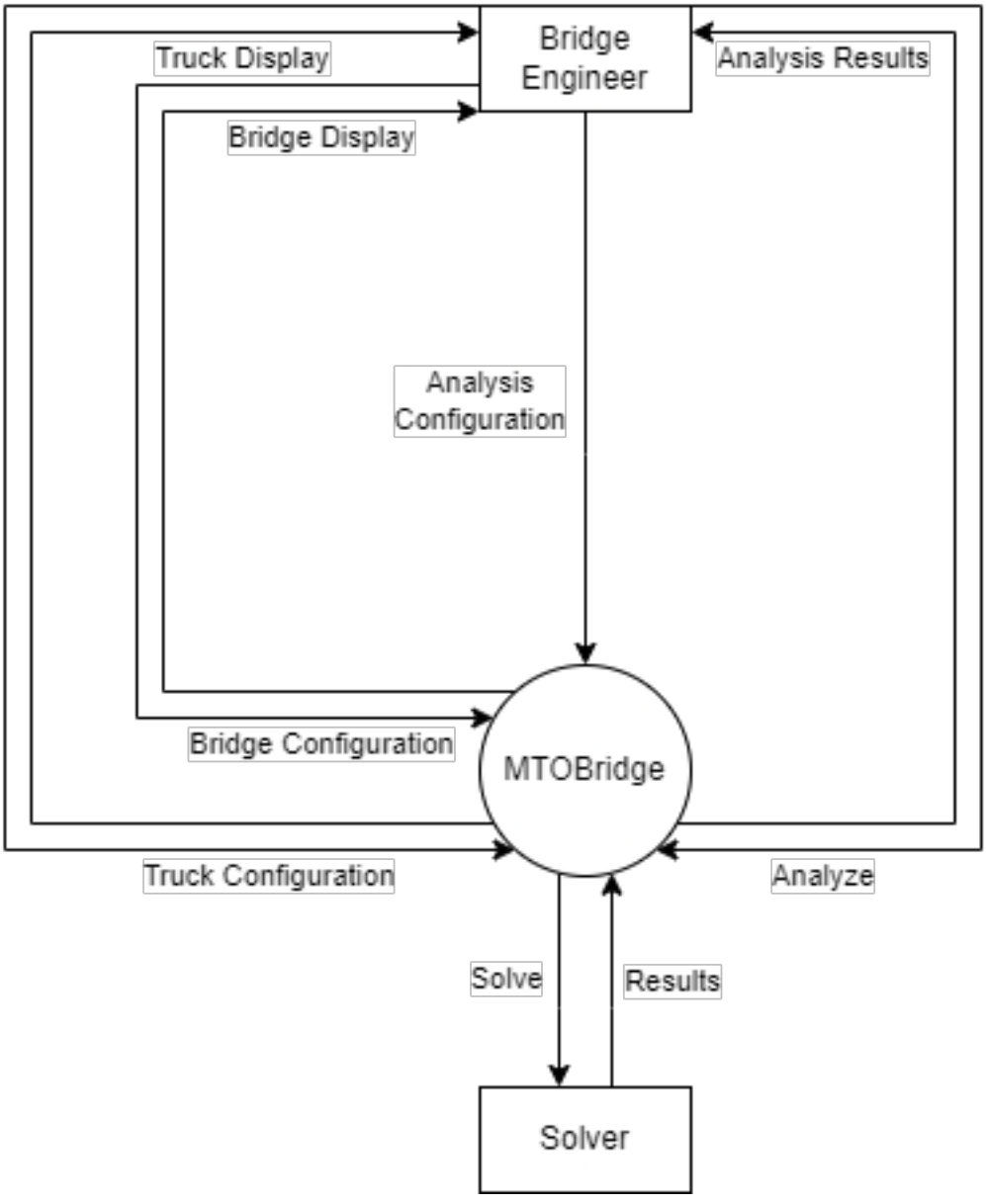

Figure 1: Context Diagram of MTOBridge

2.1.2 Work Partitioning

Table 2: Business Event List

Event Name	Input/Output	Summary
Engineer enters truck configuration	IN: Truck configuration, OUT: Truck display	Record truck configuration, show truck visualization
Engineer enters bridge configuration	IN: Bridge configuration, OUT: Bridge display	Record bridge configuration, show bridge visualization
Engineer enters analysis configuration	IN: Analysis configuration	Record analysis configuration
Engineer requests analysis	IN: Analyze request, OUT: Analysis results	Display analysis results
Time to solve forces	OUT: Solve request, IN: Solver results	Give configurations to solver to get results

2.1.3 Individual Product Use Cases

User selects the Truck Configuration Tab
Pre Condition: None
Post Condition: None
Basic Flow: None
Extension: None

User selects the Truck Configuration Tab
Pre Condition: None
Post Condition: None
Basic Flow: None
Extension: None

User selects the Truck Configuration Tab
Pre Condition: None

Post Condition: None
Basic Flow: None
Extension: None

User selects the Truck Configuration Tab
Pre Condition: None
Post Condition: None
Basic Flow: None
Extension: None

User selects the Truck Configuration Tab
Pre Condition: None
Post Condition: None
Basic Flow: None
Extension: None

2.2 Functional Requirements

FR.1 The Program should be able to call the backend MATLAB functions.
Rationale: To visually display the outputs corresponding to user input, the UI needs to first figure out what those outputs are via the backend MATLAB.
Fit Criterion: Testing will be performed to confirm whether or not the program can successfully call the MATLAB functions.

FR.2 The Program should allow the user to define the characteristics of the truck platoon, including truck configuration, number of trucks, headway, and travel speed.
Rationale: The goal of the program is to determine the forces exerted by a given platoon on a bridge, they can come in many different forms, so flexibility in the characteristics of the platoon are necessary for the relevance of the simulation.
Fit Criterion: At least one method of input(text based, dropdown list, etc) exists that allows users to correctly specify those 4 characteristics of the platoon.

FR.3 The Program should allow the user to visualize the effects of their truck platoon characteristic definitions on the final platoon.
Rationale: This is mainly to help the user verify that the inputs they put into the program correspond to the platoon they had in mind. As we are making a GUI, visual feedback is paramount to functionality.
Fit Criterion: There exists some visual representation of the truck platoon that changes to correctly reflect the impact of changes in user input.

FR.4 The Program should allow the user to save their current truck platoon configuration for later use.
Rationale: Users may be interested in testing the demands a particular truck platoon places on bridges disproportionately more often than others, in multiple situations, and over multiple sessions. Making it so they don't have to manually remake it every time is important for the efficient use of The Program.
Fit Criterion: The Program is capable of storing a truck platoon configuration in some form to be retrieved later.

FR.5 The Program should allow the user to load in their previously saved truck platoon configurations.
Rationale: A companion piece to FR.4, the ability to save a configuration is functionally useless if you can't pull it back out later.
Fit Criterion: The Program is capable of correctly recreating a truck platoon configuration from previously saved data.

FR.6 The Program should allow the user to define the characteristics of the bridge, inclduing what type of bridge it is and its length.
Rationale: Different bridges will react to the same truck platoon differently, therefore specifiying the relevant characteristics of the bridge is necessary for the relevance of the simulation.
Fit Criterion At least one method of input(text based, dropdown list, etc) exists that allows users to correctly specify those 2 characteristics of the bridge.

FR.7 The Program should allow the user to visualize the effects of their bridge characteristic definitions on the final bridge.
Rationale: This is mainly to help the user verify that the inputs they put into the program correspond to the bridge they had in mind. As we are making a GUI, visual feedback is paramount to functionality.
Fit Criterion: There exists some visual representation of the bridge that changes to correctly reflect the impact of changes in user input.

FR.8 The Program should allow the user to save their current bridge configuration for later use.
Rationale: Users may be interested in testing a particular bridge configuration disproportionately more often than others, in multiple situations and over multiple sessions. Making it so they don't have to manually remake it every time is important for the efficient use of The Program.
Fit Criterion: The Program is capable of storing a bridge configuration in some form to be retrieved later.

FR.9 The Program should allow the user to load in their previously saved bridge configurations.
Rationale: A companion piece to FR.8, the ability to save a configuration is functionally useless if you can't pull it back out later.
Fit Criterion: The Program is capable of correctly recreating a bridge configuration from previously saved data.

FR.10 The Program should allow the user to define which of the two solvers they are interested in using.
Rationale: as the MATLAB backend can solve for both the demand on a concerned section as the platoon drives along, as well as for which section has the highest maximum demand over the course of the whole trip, and these are very different pieces of info, allowing the user to determine which they are currently interested in is important.
Fit Criterion: At least one method of input(text based, dropdown list, etc) exists that allows the user to accurately choose which solver they are would like to use.

FR.11 The Program should allow the user to define a section of concern on the bridge.
Rationale: The first solver revolves around calculating the demand on a certain point along the bridge as the truck platoon drives over, specifying what point it is that we care about is necessray for this function.
Fit Criterion: At least one method of input(text based, dropdown list, etc) exists that allows the user to accurately determine a section of concern on the bridge.

FR.12 The Program should allow the user to define a discretization length for their bridge.
Rationale: The second solver finds which section has the maximum demand placed on it over the course of the platoon's trip. The discretization length determines how many sections the bridge is split up into, which is necessary for the functioning of the second solver.
Fit Criterion: At least one method of input(text based, dropdown list, etc) exists that allows the user to accurately define a discretization length for their bridge.

FR.13 The Program should allow the user to define which type of demand placed on the bridge they are interested in, between shear forces and positive/negative moment.
Rationale: There are a variety of different demands placed on the bridge as the platoon drives over, and the MATLAB backend contains calculations for all 3 of the above mentioned demands. Allowing the user to define which of the 3 they are interested in seeing is necessary for the functionality of the simulation.
Fit Criterion: At least one method of input(text based, dropdown list, etc) exists that allows the user to correctly define which of the 3 demands they are interested in simulating.

FR.14 The Program should be capable of visualizing the results of the concerned section calculation for the user.

Rationale: This is essentially the main purpose of the GUI; displaying the results of the MATLAB backend calculations visually to the user. This is one of the two main caluclations to be represented, so this functionality is very necessary.
Fit Criterion: There exists an accurate visualization of the mathematical results of the concerned section calculation.

FR.15 The Program should be capable of visualizing the results of the critical section calculation for the user.
Rationale: This is essentially the main purpose of the GUI; displaying the results of the MATLAB backend calculations visually to the user. This is one of the two main caluclations to be represented, so this functionality is very necessary.
Fit Criterion: There exists an accurate visualization of the mathematical results of the critical section calculation.

FR.16 The Program should be capable of outputting a report summarizing the results of its runtime.
Rationale: Having a long term representation of the data presented in the program after the current session of use is over is helpful for engineers comparing and contrasting diffrent simulations over time. Without this, the information would be lost as soon as the program was exited.
Fit Criterion: There exists an accurate report that cotains all the relevant data from simulations run over the course of the runtime in some output format.

3 Non-functional Requirements

3.1 Look and Feel Requirements

NFR.? graphics (ui, animations, graphic element choice e.g. bridge mockup triangle/circle) will be informative, unobtrusive, and not distracting.
Rationale: no shit

Fit Criterion: reviewed by client contacts (civil engineers)?
Traceability: ?.

NFR.? (Is this look and feel or performance??) UI elements will react promptly to user input.
Rationale: The users of the program will want the UI to react quickly to their input.
Fit Criterion: No UI element will take more than 50ms to react to user input. Here we use react to refer to the UI aknowledging the users input (e.g. a button showing a click animation), not as in the program performing calculations based on the user input.
Traceability: ?.

3.2 Usability and Humanity Requirements

NFR.? program will be intuitive to use.
Rationale: no shit
Fit Criterion: reviewed by civil engineers (our client contacts) to eliminate unintuitive controls?
Traceability: ?.

NFR.? program will have a user manual and (user-based) documentation provided.
Rationale:so that new people can actually use it quickly.
Fit Criterion: they exist, idfk. review??
Traceability: ?.

NFR.? The product will appear correctly on different display resolutions.
Rationale: Users of the product may wish to use it on displays of different resolutions.
Fit Criterion: The Program will be viewed and its appearance validated on displays of different resolutions.

Traceability: ?.

NFR.? The product will allow for the resizing of text.
Rationale: Users of the product may wish to increase text size to allow for easier reading of the text.
Fit Criterion: We will ensure that the text size within the program is resizable, and that the program still functions correctly when the text size is changed.
Traceability: ?.

3.3 Performance Requirements

reliability and availability reqs? capacity reqs? probably N/A

Maybe speed on calculations is like a % of the MATLAB (as in 90% of the calculation time is the MATLAB script or something)

NFR.? speed will be not unreasonably slow.
Rationale: no shit
Fit Criterion: ...program will not cause more than 1 second delay to any valid user input (independent of matlab component)?
Traceability: ?.

NFR.? precision reqs(!), program will be precise.
Rationale: no shit a bridge simulator should be precise.
Fit Criterion: calculations are accurate to within (???)% relative error of (other bridge simulation engine).
Traceability: ?.

3.4 Operational and Environmental Requirements

system/enviro constraints? if not a portability req

partner applications? if matlab integration not already mentioned

NFR.? (Not sure about this one tbh) The Program should run within performance requirements on expected users' (MTO engineers) computers.
Rationale: The Program must be able to run within requirements on the computers that it is intended to be used on.
Fit Criterion: Performance testing will be done on a computer with the same (or reasonably similar) hardware.
Traceability: ?.

3.5 Maintainability and Support Requirements

portable for windows 10, distributable for standalone(!) use on windows 10 rationale: expected users dont all have matlab but will use windows 10 fit criteria: test it

NFR.? The product shall be easily maintainable.
Rationale: The code must be easily maintainable to allow for future bug fixes and/or feature additions.
Fit Criterion: We will use file length, method length, and nesting depth as our primary indicators of code maintainability.
Traceability: ?.

3.6 Security Requirements

NFR.? protect private mtobridge assets.
Rationale: why DO they not want their code uploaded anyway? ...confidentiality? why...?
Fit Criterion: don't upload them to the git my dude.
Traceability: ?.

3.7 Cultural Requirements

NFR.? The Program should be able to be easily translated into other languages.
Rationale: People who don't speak English, especially French speakers as Canada is a bilingual country, may wish to use the program.
Fit Criterion: ?.
Traceability: ?.

3.8 Legal Requirements

Thing about MATLAB being private?

Any requirements for regulatory shit? This is being used to build bridges after all

3.9 Health and Safety Requirements

Any requirements for regulatory shit? This is being used to build bridges after all

4 Project Issues

4.1 Open Issues

N/A; there are currently no open issues for our project.

4.2 Off-the-Shelf Solutions

N/A; since we are using novel calculations designed specifically for this project, there are no comparable off-the-shelf solutions to our product.

4.3 New Problems

N/A; there are currently no new problems for our project

4.4 Tasks

N/A; there are currently no required tasks for our project.

4.5 Migration to the New Product

N/A; this product is novel and would not be replacing an existing product.

4.6 Risks

4.7 Costs

No monetary costs are involved in creating this product. The only costs in developing the product are the project team's time, and Dr. Yang's and their graduate students' time.

4.8 User Documentation and Training

An extensive user manual with case study examples will be produced alongside the product. This documentation will allow for bridge engineers to become familiar and comfortable using the software. We will also train Dr. Cancan Yang and their graduate students to use the product so that they can effectively present the product to the MTO.

4.9 Waiting Room

N/A; we don't currently have any requirements in the project waiting room.

4.10 Ideas for Solutions

N/A; we have not currently made any decisions about solution ideas.

5 Appendix

This section has been added to the Volere template. This is where you can place additional information.

5.1 Symbolic Parameters

The definition of the requirements will likely call for SYMBOLIC_CONSTANTS. Their values are defined in this section for easy maintenance.

5.2 Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning. Please answer the following questions:

1. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.

2. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?