

**Virtual Design and Construction (VDC) Time Study**

# **Metrics Creation Tools**

## **User Manual**



Prepared by the UW VDC Time Study Research Team

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# 1 Introduction

## 1.1 Purpose

This manual provides detailed guidance on utilizing the TableTransformation and MetricsCreation tools. Both tools are designed to assist companies in calculating and evaluating their time spent on Virtual Design and Construction (VDC) tasks.

## 1.2 About Tools



TableTransformation converts your company’s raw data into a structured format, creating standardized metrics that can be compared against—and contributed to—the VDC Time Study benchmark.



MetricsCreation enables you to visualize the transformed data by customizing various parameters to meet your specific needs.

## 1.3 Scope of the Manual

This manual covers the installation, configuration, and operation of TableTransformation and MetricsCreation tools. It includes step-by-step instructions, troubleshooting tips, and advanced use cases to help users understand VDC tasks and time metrics.

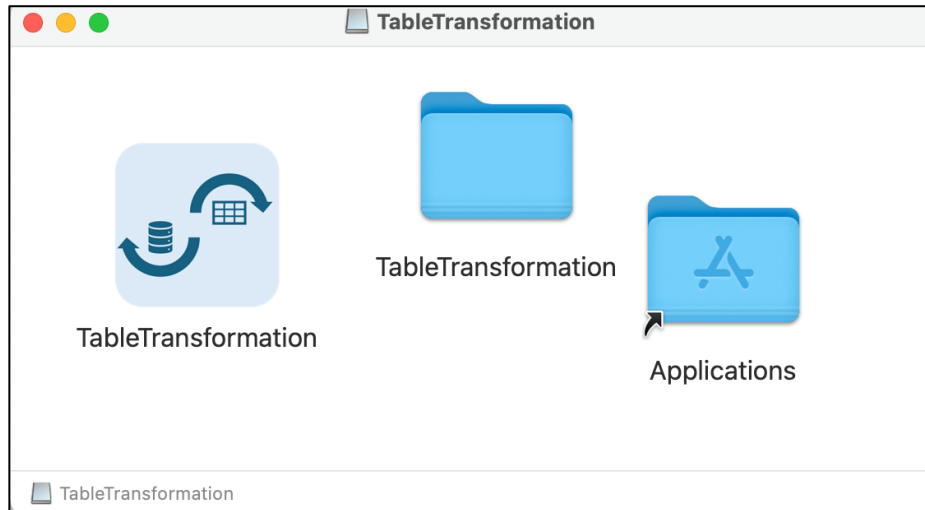
## 1.4 How to Use This Manual

This manual is structured to guide users from basic setup to advanced configurations. New users can follow the sections sequentially, while experienced users can reference specific sections as needed. **For quick navigation, refer to the Table of Contents and the Indexes.**

## 2 Initial Configuration

### 2.1 MacOS Package

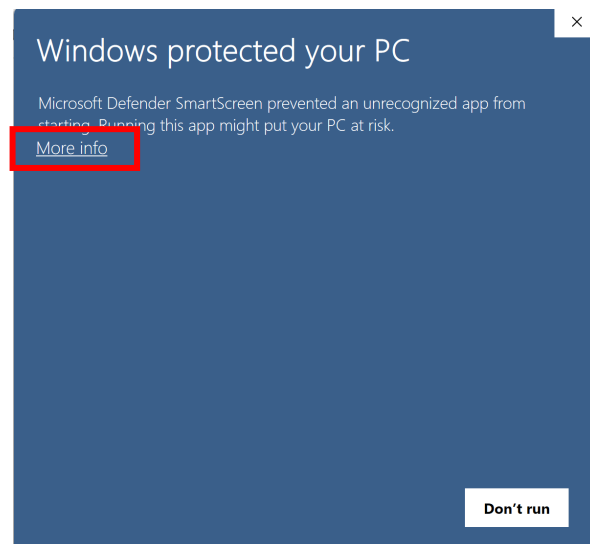
Download the packages that end with .dmg and double-click on them to initiate the installation process (**Figure 1**). Next, drag the TableTransformation package (shown on the left) into the “Applications” folder (shown on the right). Another package should follow the exact same process.



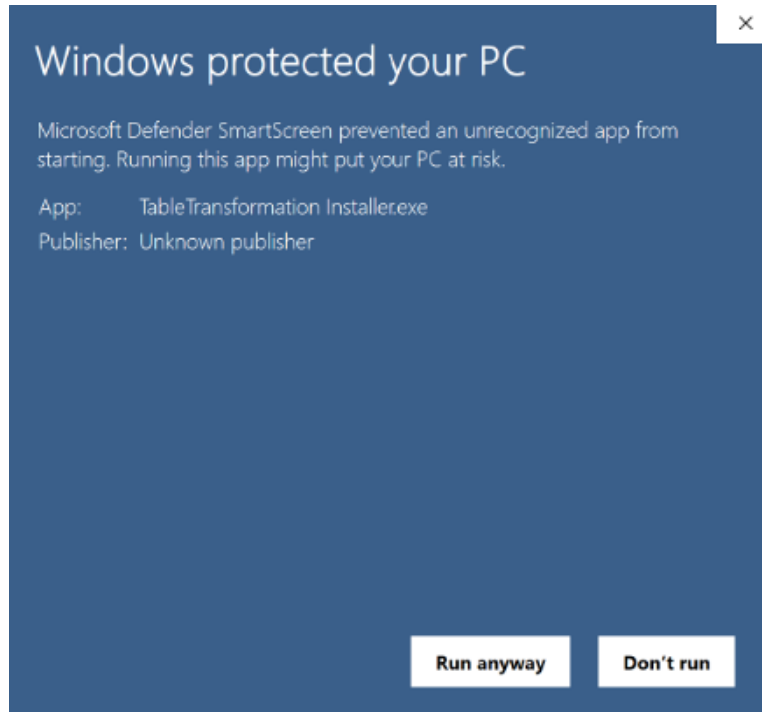
**Figure 1. Software Installation**

### 2.2 Windows Installer

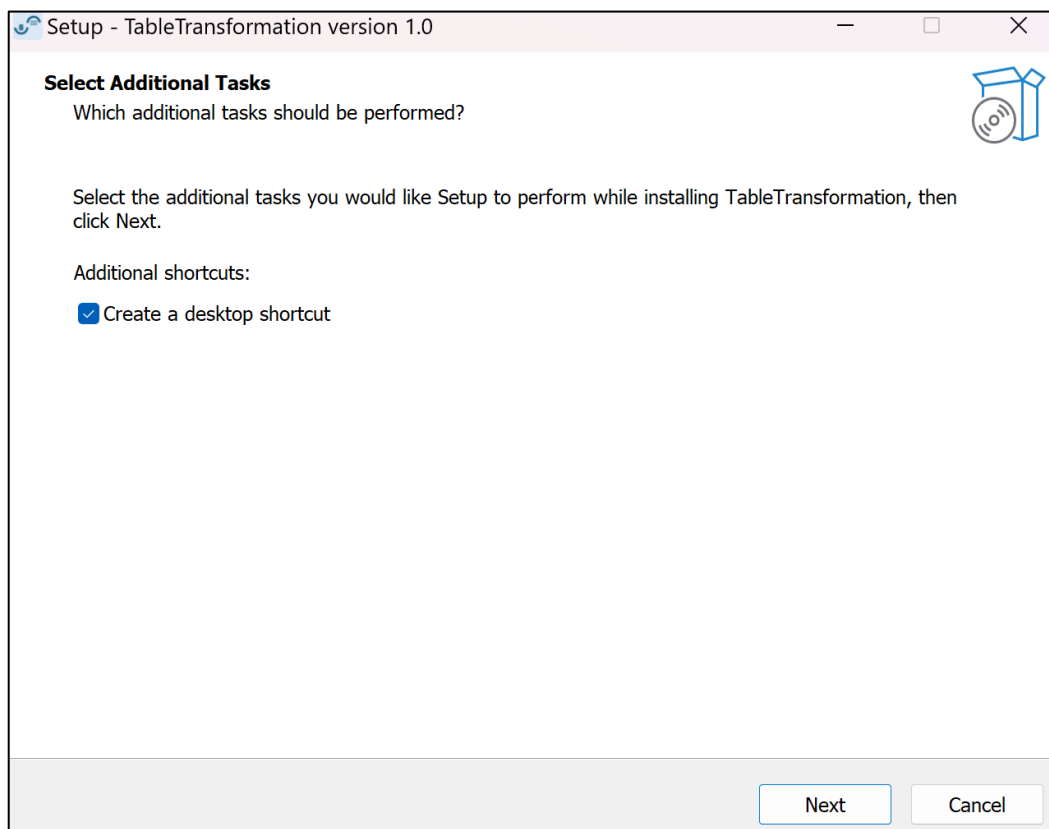
The packages for the Windows platform have a file extension of .exe. Due to security protocols, installing these packages on a Windows system may require additional approval steps. When you open the package for the first time, you may see a notification similar to the one shown in **Figure 2**[Error! Reference source not found.](#) To proceed, click “More info”, which will reveal the “Run anyway” option (**Figure 3**). Select this option, and Windows will allow you to begin the installation process (**Figure 4**).



**Figure 2. Windows Protection Notification (1)**



**Figure 3. Windows Protection Notification (2)**



**Figure 4. Start Installing**

### 3 Getting Started

#### 3.1 TableTransformation

##### 3.1.1 Preparing Data

The tool requires the columns listed in **Table 1** to be present in the original raw data table you plan to import, ensuring they are in the correct format. Null values cannot be processed, so users should verify their data carefully before importing. The tool includes a built-in “Group By” function, eliminating the need for pre-processing or data cleaning from your side. Additionally, we recommend analyzing completed and incomplete project data separately to ensure accurate and meaningful insights, tailored specifically to the unique purposes of each dataset. **Table 2** offers a checklist to assist you in preparing your data.

**Table 1. Required Data and its Format**

Data Schema	Explanation	Available Options	Format
company	Your company identifier		Text
project	Each project is assigned a unique project number or identifier for reference and tracking purposes.		Text
trade	It refers to the project’s specialized work or services provided.	Arch Metals, Electrical, Mechanical, Fire Protection, Piping, Plumbing, Sheet Metal, BIM Support.	Text
vertical_market	It refers to the project’s specific industry or sector.	Commercial, Data Center, Government, Healthcare, Industrial, Higher Education, Life Sciences, K-12 Education.	Text
new_retrofitting	This categorization identifies whether a project is a new construction or a retrofitting project.	New Construction, Retrofitting.	Text
role	The employee's role who submitted this data.	VDC Manager, VDC Coordinator, VDC Specialist, VDC Engineer, VDC Technician, VDC Detailer.	Text
company_task	This is the task name used for tracking VDC activities in your organization.		Text
hour_1	Time spent on the task.		Number

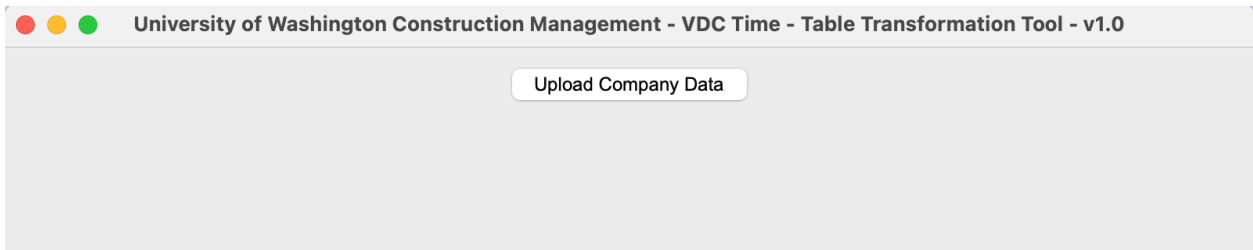
**Table 2. Checklist for Data Preparation**

No.	Item	Check
1	All required columns in <b>Table 1</b>	
2	No Null Value	
3	Only One Type of Project Data – Complete or Incomplete	
4	Correct Value Formatting – Text and Number	
5	Only One Sheet in the Workbook	
6	Compatible File Formats – .XLSX and .CSV	

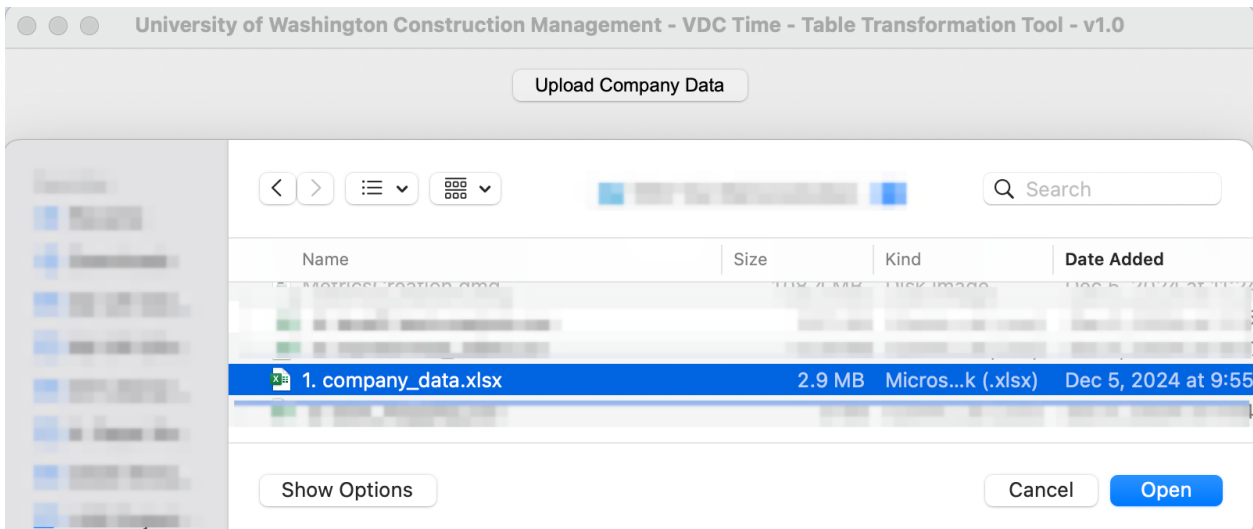
Once all items in **Table 2** are reviewed and checked, you are ready to import the data into the tool to complete the transformation process.

### 3.1.2 Import Data

Click the “Upload Company Data” button (**Figure 5**) and select the file you prepared (**Figure 6**).



**Figure 5. Import Data**



**Figure 6. File Selection**



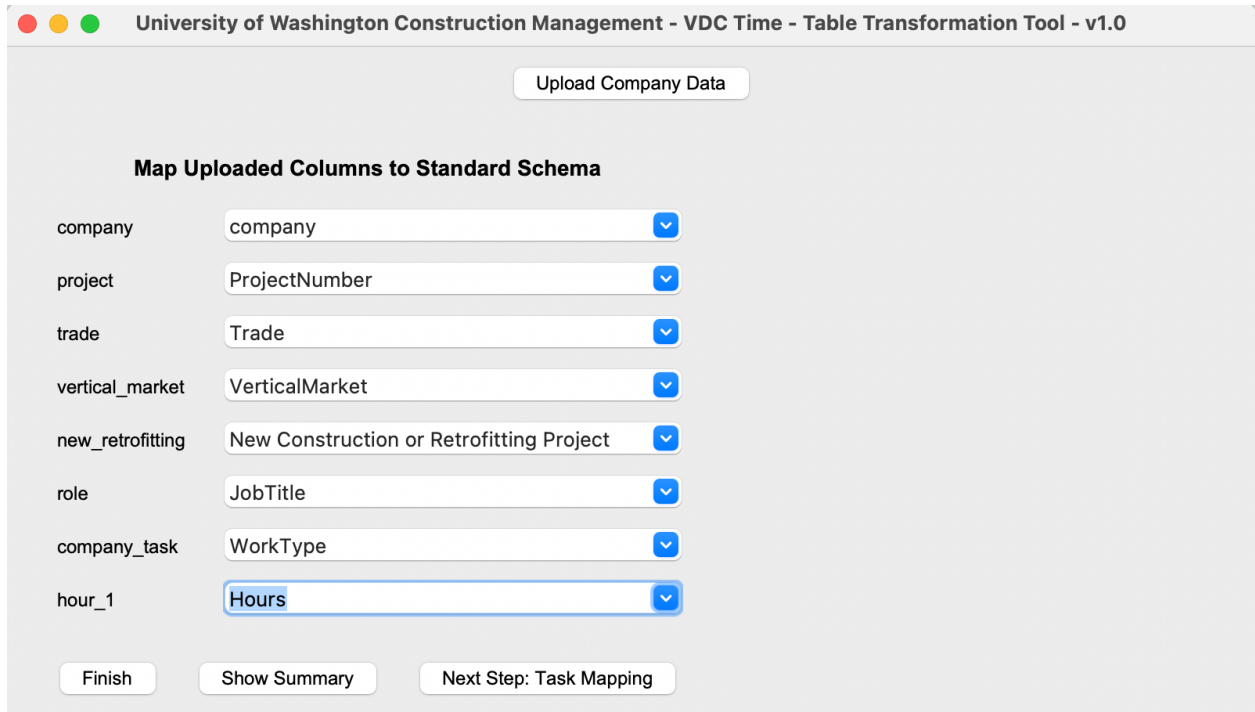
### 3.1.3 Column Mapping

Importing data might take a few minutes based on the size of the data. Once the data is successfully uploaded, you will see an interface asking you to map the columns from the company raw data file to the standard schema (**Figure 7**). This step extracts the data needed for the metrics analysis from the raw data. In this way, you do not need to change the headings or remove unused columns from the company’s raw data file. You can use it as it is exported from your system. If you adopt the same column names as in Table 1, the tool will automatically match them. Otherwise, you need to match them manually. For example, “project number” from your company data needs to be mapped with “project” in the standard schema. You are welcome to use pseudonyms for the project designations. When you submit the transformed table for the national benchmark study, the project designation is only used to compile the data. Project numbers will not be published.

Once you finish all mapping tasks, you need to click the “Finish” button, and the “Next Step: Task Mapping” button will appear (**Figure 8**).

Standard Schema Column	Selected Value
company	company
project	Please Select
trade	Please Select
vertical_market	Please Select
new_retrofitting	Please Select
role	Please Select
company_task	Please Select
hour_1	Please Select

**Figure 7. Schema Mapping**

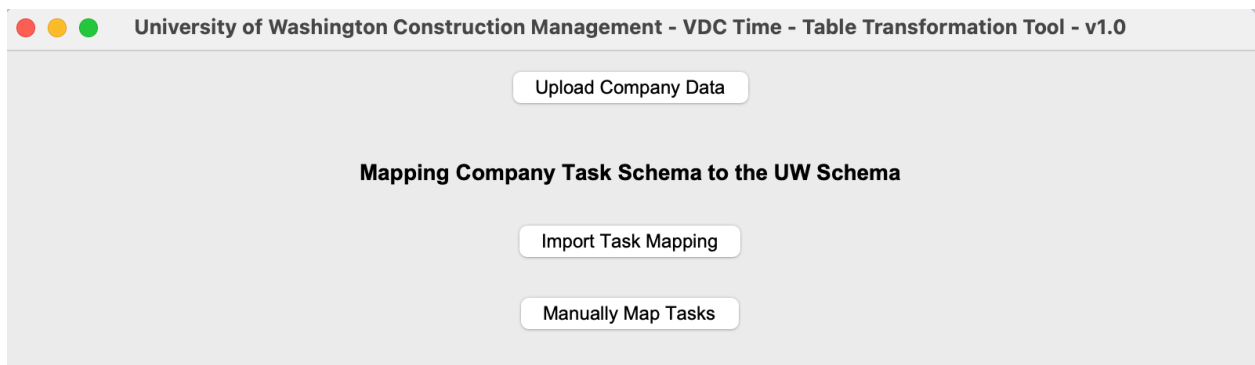


**Figure 8. Finish Schema Mapping**

### 3.1.4 Task Mapping

Since different companies may use varying task names, creating a nationwide benchmarking system requires the use of a standard VDC task framework. This step allows you to map your company’s tasks to our standardized tasks.

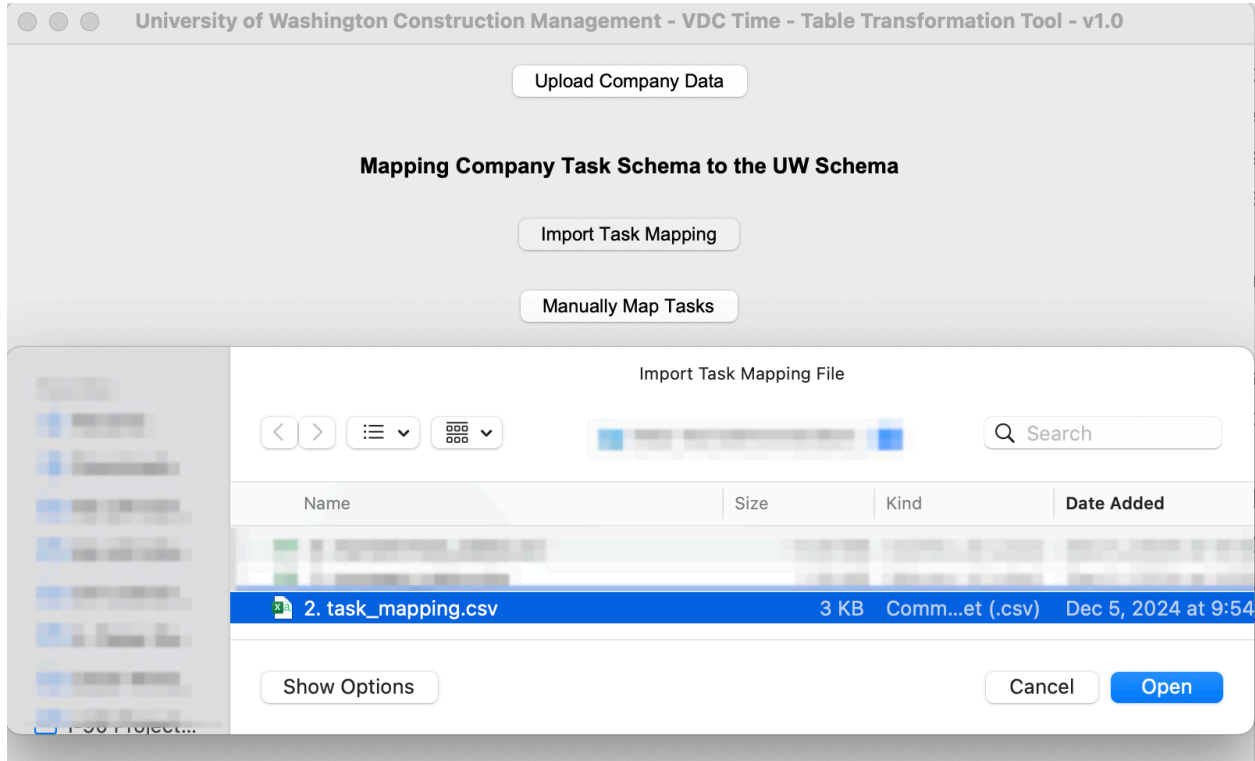
We offer two options for this process (**Figure 9**): Import Task Mapping and Manual Task Mapping. (We recommend Manual Task Mapping for first-time users). The Manual Task Mapping option allows you to export the mapped tasks at the end, enabling you to reuse the mapping in the future using the Import Task Mapping feature without repeating the entire process. If adjustments are needed later, the exported table will provide a format compatible with the Import Task Mapping option, streamlining the process.



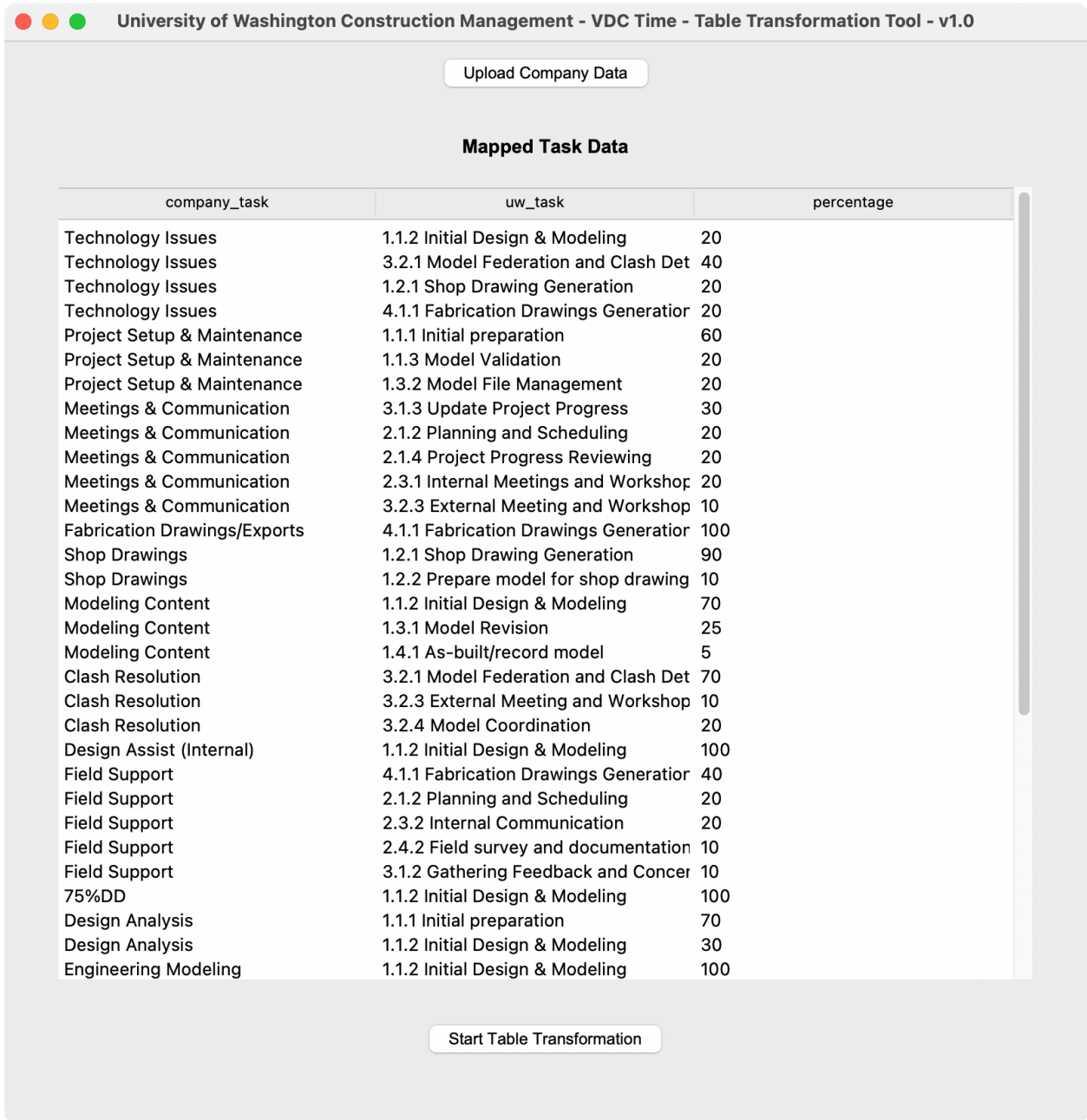
**Figure 9. Task Mapping Options**

## (1) Import Task Mapping

As shown in **Figure 10**, you need to locate and import the task mapping table into the software. Once opened, there will also be a step for you to confirm the column mapping. After that, you will see a preview of your imported table (**Figure 11**)



**Figure 10. Import Task Mapping**



**Figure 11. Task Mapping Preview**

## (2) Manual Task Mapping

**Figure 12** is the interface of the task mapping step. The interface has several main components that need your attention and rules to follow. The explanations of those components are provided in **Table 3**. The rules in this step are as follows:

- If you feel no right task could be mapped to the schema in the list, please leave it empty and click “Skip.”

- Since there might be a one-to-many relationship between your tasks and ours, we provide you with a space to enter the percentage you believe is reasonable. For instance, the company task “Coordination” could be mapped into 30% of the task “A” and 70% of the task “B.” The sum of the percentage should be 100.

\* As a reminder, at the end of the process, we encourage you to export your mapped table. The “Export” button will be enabled once you’ve confirmed the mapping process.

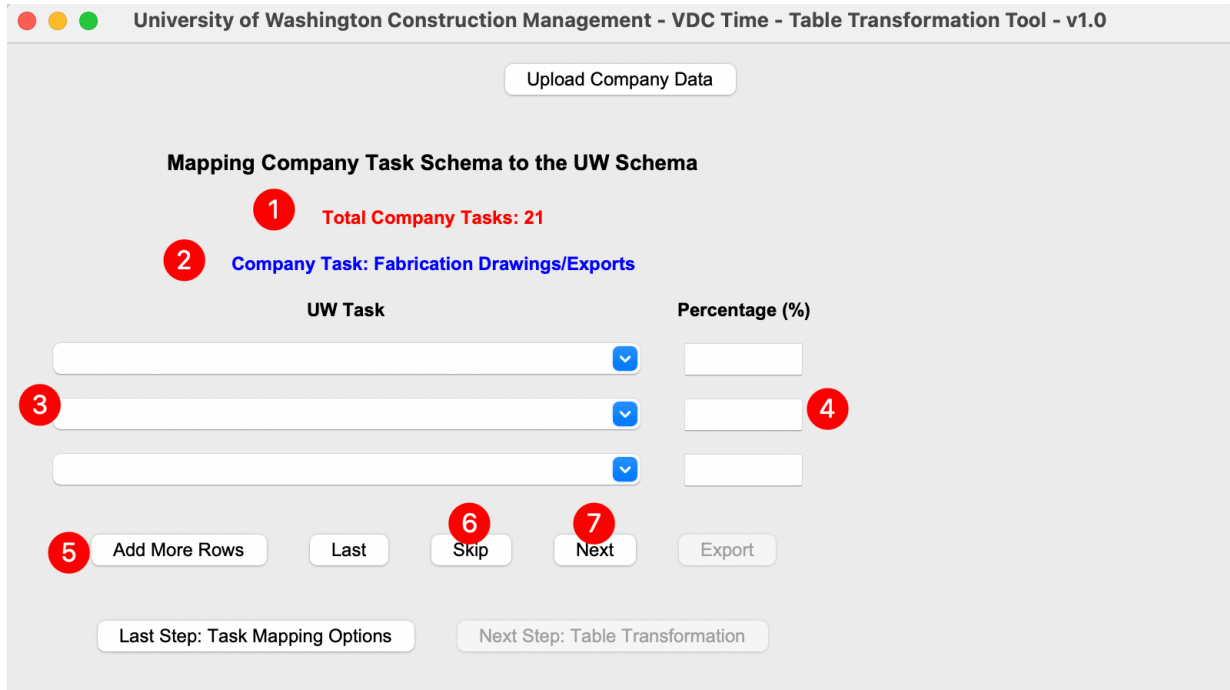


Figure 12. Manual Task Mapping

Table 3. Task Mapping Interface Components

Key	Explanation
1	The number of unique tasks in the imported data
2	Current company task
3	Tasks mapping area to select from the standardized task list
4	Percentage allocation area
5	If you have more than 3 tasks mapped into the standard schema, you could click it to add more rows
6	Used for the situation when there is no appropriate task selection
7	The “Next” button enables you to move on to the next task. Once all tasks have been mapped, it will transition to the “Confirm” button.

### 3.1.5 Table Transformation and Export Table

Once the mapping is complete, the table transformation process is fully automated. It will display a preview of the transformed data. At the bottom, there will be an option to export the transformed table for further use (Figure 13). You can submit the transformed table to the UW team to include your data in the national benchmark metrics. You will also use the exported table for the next app MetricsCreation.

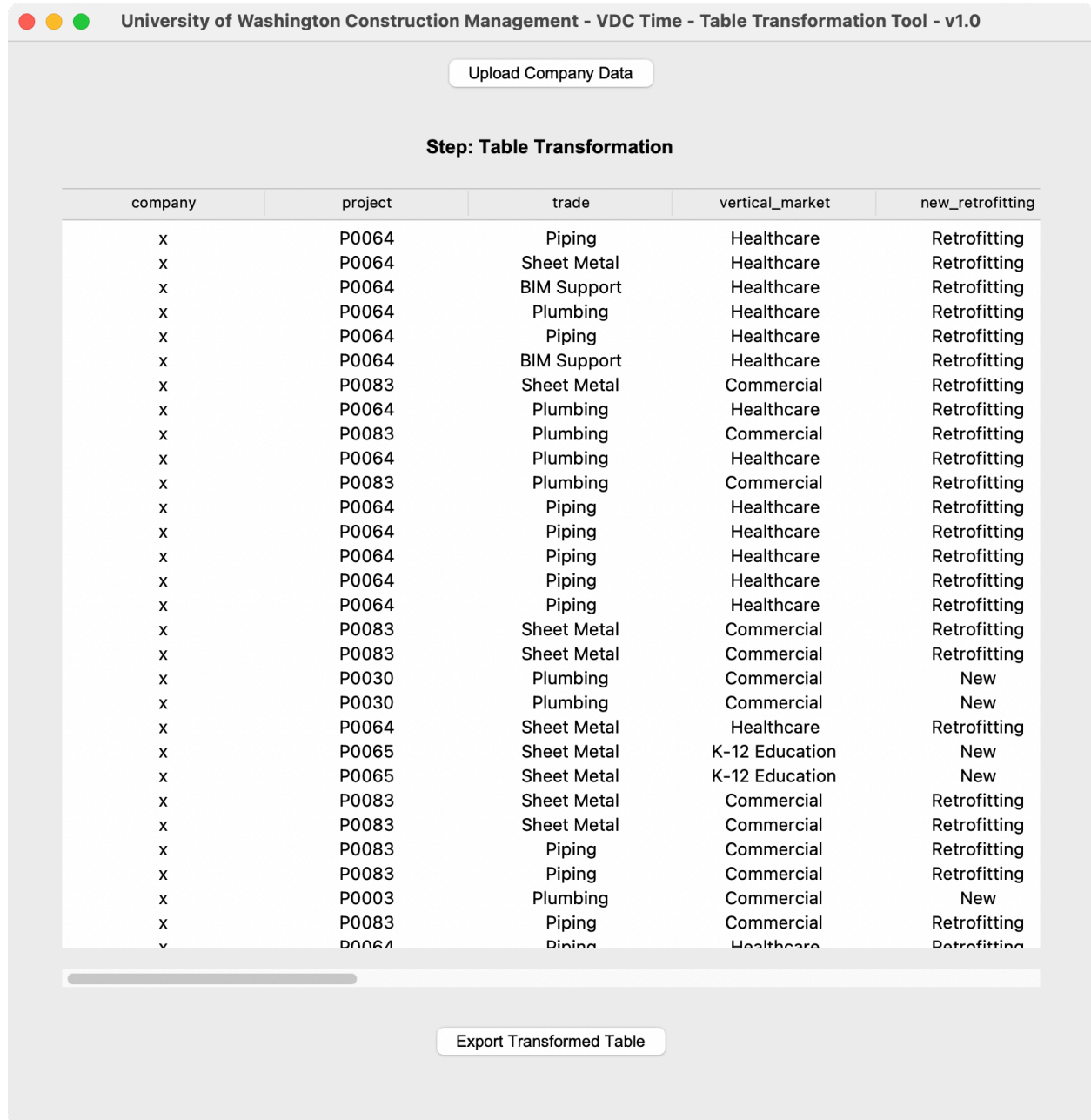


Figure 13. Preview of Transformed Table

## 3.2 MetricsCreation

### 3.2.1 Import Data

The file exported from the TableTransformation Tool can be directly imported into the MetricsCreation Tool (*3.transformed\_table.csv* in Figure 14 is the table we saved the from TableTransformation process above)

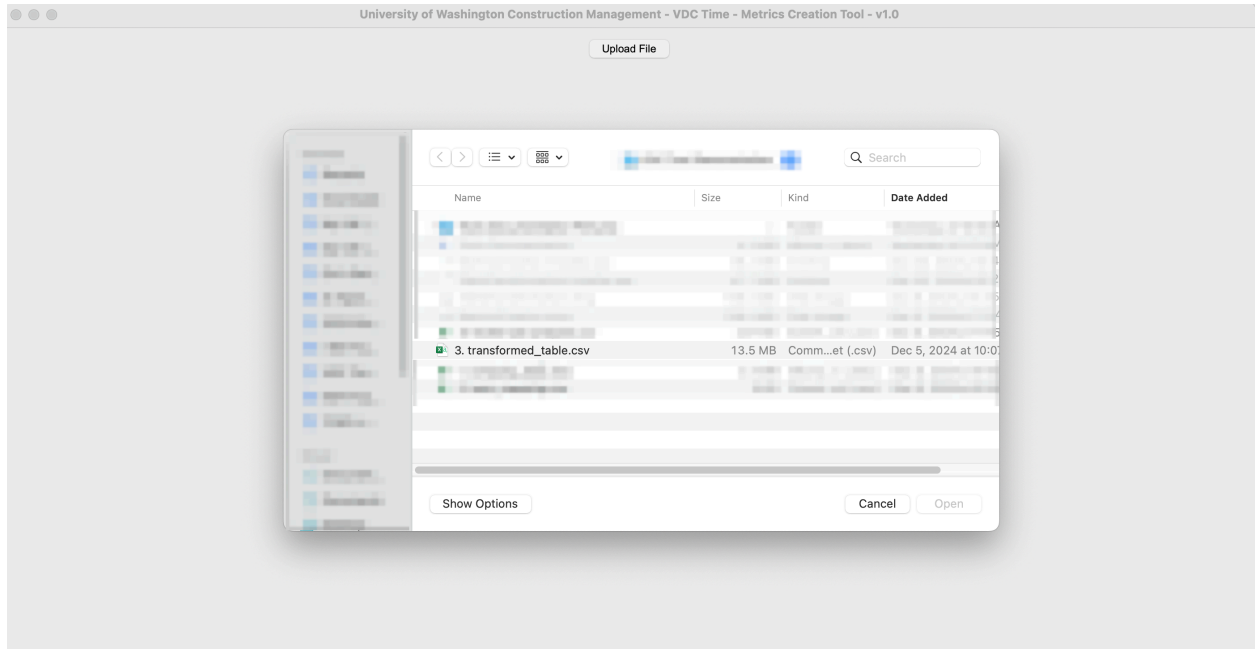


Figure 14. Import Data to Metrics Creation Tool

### 3.2.2 Value Standardization

This step involves mapping the designations for trade, vertical market, new/retrofitting and role to align with the standardized data structure for the metrics analysis. For instance, some companies might distinguish a VDC detailer’s role based on their proficiency or other criteria, but we require it to be identified simply as “VDC detailer” (Figure 15). To move to the next step, follow the instructions to select the corresponding value name. The tool will automatically identify values that match those in our list, so your input is only required for entries marked as “Please Select.” Figure 16 shows the last step of the mapping process. Once you click the “Confirm” button at the bottom, two additional buttons will appear, giving you the option to either export the table or proceed to the next step.

**Figure 15. Data mapping for VDC Roles**

Detailer Role	Mapped VDC Role
Pipefitter Detailer	VDC Detailer
Sheetmetal Detailer	VDC Detailer
Plumbing Detailer	VDC Detailer
Piping Detailer	VDC Detailer
Detailer II	VDC Detailer
Detailer III	VDC Detailer
Electrical Detailer	VDC Detailer

**Figure 16. Last Step of Confirmation**

### 3.2.3 Task Level Selection

The VDC Time Study metrics are structured into three levels. This classification allows users to create metrics tailored to different levels of task details and specific needs, ensuring a more flexible and adaptable process. To learn more about our task schema, please visit our VDC Time Study research website (<https://vdctime.be.uw.edu/>).

**Figure 17** shows the task-level selection interface. **Please select one level at a time, even though the tool does not restrict you from choosing multiple levels.** Selecting multiple levels may cause the results displayed in the next step to deviate from the intended outcome.



University of Washington Construction Management - VDC Time - Metrics Creation Tool - v1.0

Upload File

**Select Levels for Task Analysis**

Level 1

Level 2 **Please select one at a time!**

Level 3

Confirm Task Analysis Levels

Export Task Percentages

Task Selection for Benchmarking

**Figure 17. Task Level Selection**

Once the level is selected and confirmed, the benchmarking button will be enabled (**Figure 18**). Now, we are ready to visualize the final results. The “Export Task Percentages” button allows you to verify the calculations. This is an advanced feature that first-time users can disregard.

University of Washington Construction Management - VDC Time - Metrics Creation Tool - v1.0

Upload File

**Select Levels for Task Analysis**

Level 1

Level 2

Level 3

Confirm Task Analysis Levels

Export Task Percentages

Task Selection for Benchmarking

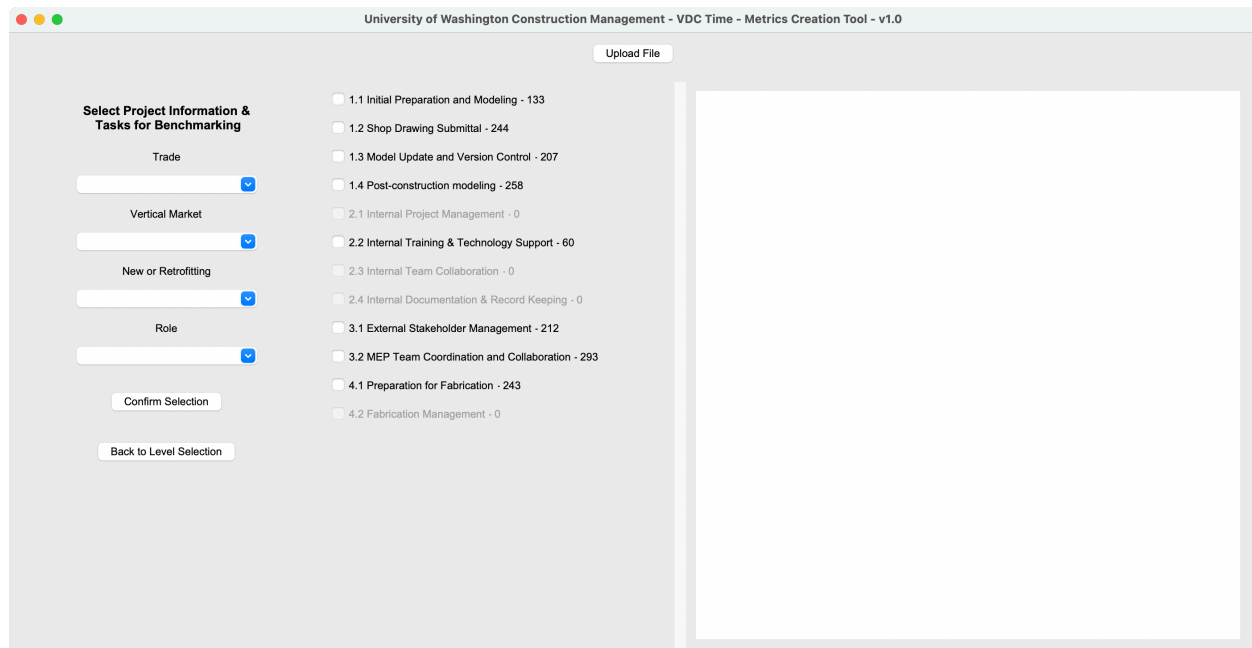
**Figure 18. Confirm Task Level**

### 3.2.4 Creating Metrics

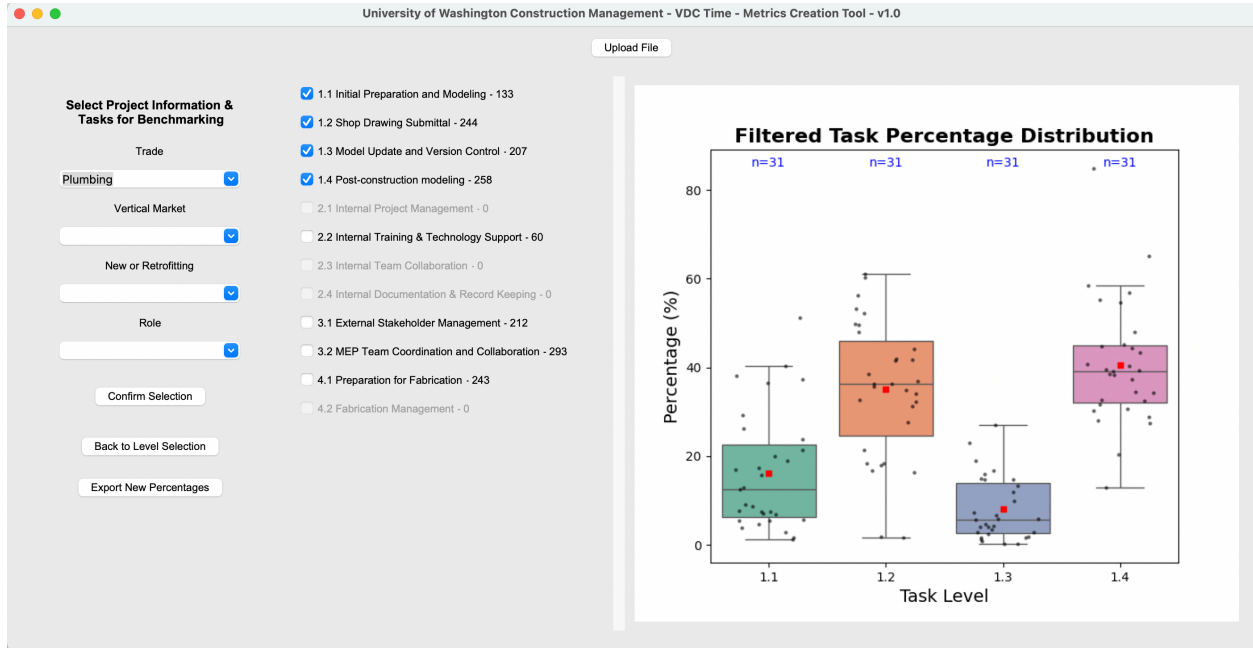
This page is divided into three main sections (**Figure 19**): project information selection, task selection, and the visualization area (arranged from left to right).

- **Project Information Selection:** In this section, you can specify details such as trade or vertical market to filter your data and gain specific insights. However, these fields are optional, and you can leave them blank if desired. Note that the tool does not automatically identify the values present in your data; instead, it displays all values from our predefined list. If you accidentally select a value not found in your data, the tool will alert you that no data exists for that selection.
- **Task Selection:** Here, you can customize the tasks you want to use for metric creation. The number displayed at the end of each task name indicates how many instances of that task are present in your data. For example, “1.1 Initial Preparation and Modeling - 133” means 133 data points are associated with that task. Tasks with dimmed text are not present in your data and cannot be selected.
- **Visualization Area:** Once you have made your selections, click “Confirm Selection,” and a metric will be plotted in the visualization area on the right side of the window.

This process is iterative, allowing you to try different combinations of tasks to generate various metrics and refine your analysis. **Figure 20** provides an example of created metrics where tasks 1.1, 1.2, 1.3, and 1.4 are selected for the plumbing trade. Please also note that the visualization in **Figure 20** is only for demonstration purposes. We are not responsible for the accuracy, completeness, or interpretation of the data shown in this example.



**Figure 19. Creating Metrics**



**Figure 20. One Example of Metric Created**

This tool allows you to return to the previous step and select a different task level for metrics creation. However, if you wish to analyze a different dataset, we strongly recommend closing the current window and reopening the tool to reset the configuration.

## 4 Contact Us

We welcome all your feedback and comments on the tools we have developed. If you have any suggestions or questions, please feel free to reach out to us through our research team email at [vdc-time-study@uw.edu](mailto:vdc-time-study@uw.edu). Your input is invaluable to us!

## 5 Acknowledgments

These tools are one of the deliverables of the VDC Time Study, sponsored by the industry associations MCAA, NECA, and SMACNA. It represents the collaborative efforts of the UW research team. We also extend our heartfelt gratitude to the contributing companies—Briggs Electric, Lighthouse Electric, McKinstry, and Binsky & Snyder—whose support and collaboration were instrumental in achieving this outcome. Each of their contributions has been invaluable in the development and success of this study.