

MDT Unit Price Visualization Tool:

User Manual



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MDT Unit Price Visualization Tool

User Manual

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Sponsored by Montana Department of Transportation

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1 INTRODUCTION

The MDT Unit Price Visualization Tool is a powerful tool to generate visual maps that shows the distribution of unit prices of bid items across the state. It can serve as a quick tool to determine the unit price of a bid item in a certain location based on historical data and interpolation algorithm. It will also help evaluate variation in the unit price of a particular bid item based on its location and quantity of work. It is an add-in tool to Environmental Systems Research Institute (ESRI) ArcGIS for Desktop. The tool requires Spatial Analyst extension. This manual provides a step by step guide to generate and save visualized maps for desired bid items.

2 INSTALLATION AND INITIAL SETUP

2.1 Installation

In order to install the tool, double click the MDT_Bid_Visualization_xxxx.esriAddIn. An add-in installation confirmation dialog box will show up as shown in Figure 1. Click Install Add-In. Another dialogue box will appear confirming the successful installation.

Esri ArcGIS Add	I-In Installation Utility					
	Please confirm Add-In file installation.					
6	Active content, such as Macros and Add-In files, can contain viruses or other security hazards. Do not install this content unless you trust the source of this file.					
Name:	MDT Unit Price Visualization Tool					
Version:	1.0					
Author:	Dr. K. Joseph Shrestha					
Description:	This add-in generates unit price visualization map.					
Digital Signati	ure/s					
This Add-In fi	le is not digitially signed.					
Signed By:	· · · · · · · · · · · · · · · · · · ·					
Signed date:	Show Certificate					
	Source is trusted					
	Signature is valid					
Install Add-In Cancel						

Figure 1 MDT Unit Price Visualization Tool Installation

2.2 Creating Menu Item

Once installed, open ArcMap and go to Customize Menu -> Customize Mode -> Commands and type "UPV" to locate the add-in (Figure 2). Drag and drop the tool to the Menu bar or any other toolbar. The tool will start by clicking on the "UPV"

Customize	Image: State Sta
Toolbars Commands Options	
Show commands containing:	upv
Categories:	Commands:
Spatial Analyst	UPV
	Description
Keyboard.) 🚱 Add From File) Close

Figure 2 Creating Shortcut for the Tool

Once you launch the program, it will show the Unit Price Map Generator interface (Figure 3).

MDT Unit Price Visualizatio	n Tool	
		List Bid Items
Bid Item ID 301020340		
Year Range	2006 👻 2016	T
Quantity Range	0 1000	
Load Bid Data	Generate Unit Price Map	Settings
Connection failed. Please edit	settings.	

Figure 3 Unit Price Map Generator Main Interface

2.3 Oracle Connection

The tool relies on data from an Oracle database. Click on the Settings button to change the connection details (Figure 4). Your IT administrator should be able to help you with the settings. The output path is the location where all the maps are saved. Once the values are changed, click "Save" button and then "Connect" button. If connection is successful, a green message stating "Connected to the Oracle database" will appear at the bottom left corner of the screen.

Connection Details		
User name	HCCI_Oracle_Limited	
Password	••••	
Connection Detail		
(DESCRIPTION=(ADE (PORT=1521))(CONN	PRESS=(PROTOCOL=tcp)(HOST= ECT_DATA=(SID=xe)))	localhost)
C:\Users	s\shresthak\Desktop\gistmp	Browse
Save		Connect

Figure 4 Connection Settings and Output Path

2.4 Enabling "Spatial Analyst" Extension

The tool uses Spatial Analyst extension for the ArcMap and will throw an error if the extension is not enabled. To enable the Spatial Analyst extension, go to Customize Menu -> Extensions (Figure 5).

Extensions 2	3
Select the extensions you want to use.	
3D Analyst ArcScan Geostatistical Analyst Network Analyst Publisher Schematics Spatial Analyst Tracking Analyst	
Description:	
3D Analyst 10.4.1 Copyright ©1999-2016 Esri Inc. All Rights Reserved	
Provides tools for surface modeling and 3D visualization.	
Close	

Figure 5 Enabling Spatial Analyst

The tool can now be used to generate unit price maps.

3 GENERATING VISUALIZATION MAP

Unit price maps can be generated in four steps: a) type bid item ID, b) set calendar year and quantity range to filter projects, c) click on the "Load Bid Data" to unit price data, d) click on the "Generate Unit Price Map" to generate maps. A video tutorial is also available on <u>YouTube</u> (<u>https://youtu.be/Q9B04ed6CXo</u>).

3.1 Listing Available Bid Items

If a bid item ID is not known, click on the "List Bid Items" to list all available bid item IDs, descriptions, and units. Double click any bid item id (REFITEM_NM column) to copy the ID to the Bid Item ID field. Changing a Bid Item ID will change the color of "Load Bid Data" button to red indicating the next step in the process of generating the maps (Figure 6).

UPV M	MDT Unit Price Visualization Tool								
AII E	Bid Ite	ms from MDT Speci	fication Book	List Bid Items					
		REFITEM_NM	DESCR	UNIT ^					
	40	301020253	BRIDGE END BACKFILL-TYPE 2	CUYD					
	40	301020254	BRIDGE END BACKFILL-TYPE 3	CUYD					
	40	301020268	TRAFFIC GRAVEL	CUYD					
	40	301020269	TRAFFIC GRAVEL	TON					
	40:	301020338	EMULS ASPH TREATED BASE CO	CUYD					
•	41	301020340	CRUSHED AGGREGATE COURSE	CUYD					
	41	301020345	CRUSHED AGGREGATE COURSE	TON					
	41:	301020346	CRUSHED AGG COURSE - BLEND	CUYD					
	41:	301020413	GUARDRAIL END SECTION WIDE	EACH					
	41	301020415	SHOULDER GRAVEL	TON					
	41	301020416	SHOULDER GRAVEL	CUYD					
	41	301020450	SPECIAL BACKFILL	CUYD					
	41	301020451	SPECIAL BACKFILL	TON 👻					
Bid	ltem I	D 301020340							
	Year	Range	2006 👻 2016	T					
	Quan	tity Range	0 1000						
	Load Bid Data Generate Unit Price Map Settings								

Figure 6 General Interface of the Tool

3.2 Calendar Year and Quantity Filter

The "Year Range" checkbox enables users to populate bid data from a specified range of calendar years to generate maps. Similarly, the "Quantity Range" checkbox allows users to list bid data within a specified range of quantities. This can be useful if the unit price of an item fluctuates widely over years or if unit prices are very high for smaller quantities of the item. If any filter parameters are changed, data needs to be reloaded by clicking the "Load Bid Data" button.

3.3 Loading Bid Data

Click on the "Load Bid Data" button to load data based on which maps will be generated (Figure 7). Clicking this button will change the color of "Generate Unit Price Map" to red.

MDT Unit Price Visualization Tool									
Unit Pri	Unit Prices for bid item 301020340								
	UNIT_PRICE	LONGITUDE_DEG	LATITUDE_DEGR	LET_DATE	^ (
▶ 1	9.90	-108.4667	46.0311	6/7/2012	21				
2	9.90	-108.4667	46.0311	6/7/2012	21				
3	11.56	-111.9778	46.1331	1/28/2010	21				
4	11.64	-111.1858	45.6942	1/26/2012	21				
5	13.23	-109.6306	47.1197	4/11/2013	21				
6	13.45	-111.7078	46.5194	8/15/2013	21				
7	13.50	-114.6058	47.7792	1/14/2010	21				
8	13.95	-105.0475	48.8158	6/10/2010	21				
9	14.00	-111.7008	47.2708	3/10/2011	21				
1	14.60	-109.5414	47.2269	9/23/2010	21				
1	14.61	-112.5522	46.9803	1/16/2014	21				
1	14.64	-106.8206	46.2500	9/26/2013	21				
•					•				
Bid Item	n ID 301020340								
Yea	r Range	2006	- 2016	-					
🔲 Qua	antity Range	0	1000						
l	Load Bid Data	Generate Unit	Price Map	Settings					
Connected to the Oracle database.									

Figure 7 Unit Price List

3.4 Generating Unit Price Visualization Map

Click on the "Generate Unit Price Map" button to generate a unit price visualization map (Figure 8). The map will show color coded unit prices based on the lowest (green) and highest (red) unit price locations. A legend is automatically added in the layout view.



Figure 8 Unit Price Visualization Map

3.5 Unit Price Labelling

The visualization maps are based on the unit prices of various items at various locations. Those unit prices from previous projects can be displayed in the map. Right click on the Unit_Price_Template -> Properties (Figure 9).



Figure 9 Properties of Unit Price Template Layer

Go to Labels tab and choose Unit_Price from Label Field dropdown box (Figure 10). Check the "Label features in the layer" checkbox. Click OK. It should now show the unit prices of the item at various locations (Figure 11). If desired this label can be turned off again by clicking on the "Label Features" on the right click menu of the Unit_Price_Template Figure 9).

Layer Prop	erties	-		Ì		- 7							x
General	Source	Selection	Display	Symbology	Fields	Definition	Que y L	abels	Jains & Rel	ates Ti	me	HTML	Popup
🔽 Labe	el features	in this layer											
Method	:	Label	all the feat	ures the sam	e way.			•					
All fea	tures will b	oe labeled u	ising the op	tions specifi	ed.								
Text	t String -												
Labe	el Field:	ld						-	Expression	ı]		
Text	t Symbol -	FIE)										
		Ū	it Price						•				
		- DbV	20			BI	Ū	Sym	bol				
Oth	er Options					r	Pre-define	d Labe	Style				
	Placeme	ent Propertie	es	Scale	Range			Labe	Styles				
									к	Cance	*	Ap	ply

Figure 10 Labels Properties



Figure 11 Unit Price Visualization Map with Unit Price Labels

3.6 Location with Specific Unit Price

Figure 7 shows a list of unit prices and their corresponding latitudes and longitudes. To locate the unit prices in the map, right click on the Unit_Price_Template (Figure 9). Click on the "Open Attribute Table." It will show a list of unit prices (Figure 12). If any row is selected, it will highlight the location of the project in the map. Alternately, "Zoom to Selected" icon can be clicked to zoom the map to the project location.



Figure 12 Attribute Table

3.7 Saving Generated Visualization Maps

The maps are automatically saved to the output path set in the Settings window. Each map is saved in folders named "<item ID> <year lower year limit – upper year limit if set> <quantity lower quantity limit – upper quantity limit if set>". Map generation may take several seconds or a few minutes depending on the number of unit price records used to generate the map. If a very few number of data are provided, the tool may not be able to generate a map and will throw an error message. Once a map is generated, another map can be generated by updating the bid item ID and filter criteria. The new map will be automatically saved to its own folder.

4 DATABASE SETUP FOR BID DATA VISUALIZATION TOOL

Both MDT Bid Data Visualization Tool and HCCI Calculation & Bid Analysis System use the same Oracle database. A database administrator can create an "HCCI_Oracle_Limited" schema and corresponding username and password. The "AllHCCIBidVisualizationDatabaseSetup.sql" file can be used to generate all required tables and data. The database administrator can create a

data update script to automatically update data in "M_BIDTABS_WINNING" and "M_PROJECT_CHARACTERISTICS" from existing databases (PPMS and SiteManager databases). Sample data are provided for those tables which should be deleted before adding data from other databases.

5 TROUBLESHOOTING

5.1 Ensure that Sufficient Number of Data are Available to Generate Map

If only a few unit price data (for example, two or three) are available to generate a map, it might show an error (Figure 13). Change the filter criteria so that more unit price data are included. For some items with a very few number of data points, the tool may not be able to generate any map.



Figure 13 Insufficient Number of Unit Price Data

6 REMARKS

- This unit price visualization tool (and also the HCCI tool that was developed as part of the contract #8232-001) can show data up to the year before the current year. This is to ensure that the seasonality effect is minimized in unit price calculation in the unit price visualization tool and the sufficient number of data points are used for highway construction cost index calculation. However, the inclusion of current year's data to date is technically feasible and can be implemented if desired in the future.
- The years in both tools are calendar years, not fiscal years.