Task #	New tasks in 3D delivery	Scope	Measurement Unit	Task Force Estimated level of effort (Hours)						Task Force Comments	*MDU Opinion on whether this work adds engineering detail to design (Y or N)	WisDOT Activity Codes (% of task work in each)		
				Task Force Member #1	Task Force Member #2	Task Force Member #3	Task Force Member #4	Task Force Member #5	Task Force Member #6			741 - Prelim Design	742 - Final Design	794 - PS&E
1	Corridor and Refinement Surface Model development	Added detail to the corridor and design model is needed for 3D design. Many elements contribute to this (slope transitions, typical section transitions, changes in pavement depth, berm and other feature transitions). Extra corridor structure leads to extra assemblies, extra targeting, etc. Dynamic relationships must be maintained. Frequency must be increased to achieve a usable model. This estimate excludes intersections as those have dedicated extra work items.										75	25	
1a		Rural Undivided Reconstruct	miles	4	4	2	3	8	4 - 8		Y	75	25	
1b		Rural Divided Reconstruct	miles	6	6	4	4.5	10	8 - 12		Y	75	25	
1c		Urban Undivided Reconstruct	miles	6	6	4	5	10	8 - 12		Y	75	25	
1d		Urban Divided Reconstruct	miles	8	8	6	6	12	8 - 16		Y	75	25	
1e		Urban Divided with Slotted Left Turns Reconstruct	miles	9	9	7	7	16	10 - 16		Y	75	25	
1f		Rural Undivided Rehab	miles	6	6	*	5**	10	4 - 12	*I have no experience with this so still unclear what needs to be done with this. **Assuming cross sections are required.	Y	75 75	25 25	
1g		Rural Divided Rehab	miles	9	9	*	7**	12	6 - 16	*I have no experience with this so still unclear what needs to be done with this. **Assuming cross sections are required.	Y	75 75	25 25	
1h		Urban Undivided Rehab	miles	0	0		0	0		If we don't have cross sections, we don't deliver models, some urban rehab projects might require models, many won't. It is assumed that cross sections/models would not be required.	Y	75	25	
1i		Urban Divided Rehab	miles	0	0		0	0		If we don't have cross sections, we don't deliver models, some urban rehab projects might require models, many won't. It is assumed that cross sections/models would not be required.	Y	75	25	
1j		Urban Divided with Slotted Left Turns Rehab	miles	0*	0*		0*	4**		*Assuming no cross sections are required. **Additional hours for projects retrofitting median to slotted lefts with no median.	Y	75 75	25 25	
2	Intersection pavement and curb return modeling (lane profiles, curb profile, and proper target assignments)	To create an accurate roadway model, the intersections must also be modeled. Other benefits may include, but are not limited to, better definition of intersection sight triangles, more accurate slope interecepts, improved drainage designs. 2D design did not model the intersection other than what the intersection looked like at stations of interest.										50	50	
2a		Undivided/Undivided 3 Leg	intersections	0.75	0.75	1	1.5	2 - 3	4	assumed horizontal geometry is already created for 2D design, and ready to data reference for corridor targeting. No need to create horizontal target objects.	Y	50	50	
2b		Undivided/Undivided 4 Leg	intersections	1.5	1.5	2	2.5	4 - 5	4		Y	50	50	
2c		Undivided/Divided 3 Leg	intersections	2	2	2	2.5	6	4		Y	50	50	
2d		Undivided/Divided 4 Leg	intersections	3	3	3	3.5	6	4		Y	50	50	
2e		Divided/Divided 3 Leg	intersections	3	3	2.5	3	6	4 - 6		Y	50	50	
2f		Divided/Divided 4 Leg	intersections	5	5	5.5	6	9	6 - 8		Y	50	50	
2g		Roundabout - Single Lane	intersections	18 - 24	18 - 24	3*		24 - 30	40	Single iteration of developing curb profiles that work and then design corridor. Extra work compared to 2d is the added Region/baseline structure and added density of sections to be built into the corridor, and also the added detail built into the vertical geometry that may have been accomplished by adding spot elevations to a detail sheet in the 2D workflow. *Estimator indicated he had no experience doing this work.	Y	50	50	
2h		Roundabout - Complex or with Bypass Lanes	intersections	24 - 36	24 - 36	6*		36 - 40	60	*Estimator indicated he had no experience doing this work.	Y	50	50	
3	temporary roadway design	The contactors want these temporary surfaces for things like widenings, median cross overs, and temporary bypasses. Estimate this effort like any other roadway. Add the length of temporary roadways into the appropriate category under item 1.		-	-	-	-	-	-	Temporary roadways should be included and estimated under item 1.	Y	50	50	
4	corridor surface creation	in 2D design, the corridor is sufficient with no proposed surfaces needed. In 3D design the corridor surface definitions take time to create and maintain.	corridor surfaces	2	2	2 - 3	1.5	3	3 - 4	assuming boundary maintenance for 4 iterations, per corridor surface, per project	N	100		
5	Rural intersection grading in the quadrants	Ditch grading in the intersection quadrands verifies that impacts, r/w acquisition, drainage, etc are all accounted for. With 2D design drainage in the quadrants was not modeled and ditches only appeared if there was a cross section at that location.	rural 4 quadrand intersections	2 - 4	2 - 4	2 - 4	3	4	2 - 8		Y	75	25	
6	Longitudinal Curb profile development	For longitudinal curb and gutter, the profiles are optional (not a deliverable). They can help the design assure proper drainage.	-	not extra work	not extra work	not extra work	not extra work	not extra work	not extra work	This item was revied by the Task Force. This task is completed with a 2D deliverable. Considered as incidental to urban corridor item	Y			
7	Rural driveways	Contractors have expressed their desire to have these in the package. Also, enables the designers to more accurately determine pipe lengths and ensure constructablility. 2D plans only represented the driveways with a line on the cross sections.										75	25	
7a		Simple driveway (grading-based)	driveways	0.25	0.25	0.5	0.25	0.5 - 0.75	1	single iteration creation to driveway design	Y	75	25	
7b		Complex driveway (requires alignment, profile, cross section sheets)	driveways	1	1	1 - 2	1.5	2 - 3	2 - 4	single iteration creation to driveway design	Y	75	25	
8	Pond and drainage swale grading objects and surface refinements	Areas not directly connected to the roadway corridor.	-	not extra work	not extra work	not extra work	not extra work	not extra work	not extra work	3D design of these areas is not thought to increase time over a 2D workflow. May be a time savings.	Y			
9	Beam guard grading	It is essential that EATs are built properly. Therefore, modeling these locations should receive additional effort to assure they fit the site conditions. 2D design only required cross sections at posts 1, 5, 9, and at even stations.	EATs	2	2	1 +/-	n/a	2 - 3	1 - 2		Y	75	25	

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10	Retaining Wall grading	Earthwork transitions at the wall ends should be modeled. Structure designers sometime ask for more details at the wall ends so they can determine where the end of wall should be. Design task force discussion indicated the length of the wall is not a factor. It is modeling the transitional areas at the ends of the walls that generate extra work in 3D design. 2D design only required cross sections at even stations and sometimes at the wall beginning and end.	wall ends	1	1	1	1	1	1	typically two ends per wall unless the wall is connected to an abutment	Y	50	50	
11	Bridges and Wingwalls	To properly capture grading work in area of abutments. This work consists of the cone of earthwork around the abutments. Note: Design task force discussion indicated extra modeling effort is not needed for box culverts.	abutments	8	8	8	8	8	8		Y	50	50	
12	Curb Ramps	Due to the potential liability of non-ADA-compliant curb ramps, the additional design effort is needed. Further more, having these models available to the contractor can help ensure they are constructed properly. Upcoming design standards may introduce further details on what is required. 2D design did not accurately model curb ramps.	curb ramps	0.75	0.75	1	1	2	1	Includes TOP and DATUM surfaces	Y	25	75	
13	EBS	This is designed excavation below subgrade, typically a known depth and the surface is useful. Transition in and out would be the extra work element. 2D design did not represent the transitions in and out of the excavations.	occurances	0.5 - 8	0.5 - 8	0.5 - 8	0.5 - 8	0.5 - 8	0.5 - 8	range of effort for ebs can vary considerably given the size of the ebs area to consider. Simple cut/fill transitions will be on the low end of the scale, extended ebs areas covering significant distance along the roadway will require designer's attention through multiple corridor regions, affecting multiple assembly designs. It is an extra effort item, but difficult to predict the extent of EBS throughout the project at the early stages, so difficult to estimate	N	50	50	
14	Pavement surface model creation	AMG for pavements technology is used elsewhere within the US, and is expected to be used in Wisconsin at some point in the not-too-distant future.	corridors	1 - 3	1 - 3	3	2 - 3	3	2 - 4	Does not inlude shoulder pavement. Includes surface boundary and intersection pavement	N		100	
15	Pavement Grades	Pavement grades are still needed in the plan. The grades are now a byproduct of the surfaces. Plans production time is reduced using surfaces to automate elevations, but engineering time and QC time remains the same.	plan sheets	-0.25	-0.25					Negative value listed means a time savings.	N			
16	General refinement surface cleanup	This work consists of surface edits such as filling in holes, deleting extra triangles, etc.	refinement surface-miles	1 - 2	1 - 2	1	1	2	1 - 2		N		100	
17	model quality control	Models must be consistent with plans. Breaklines must be consistent with surfaces. Model errors will cause construction problems. The focus should be on synchronization of model data with plan sheets and also on overall accuracy of the surfaces. This process will not include QC of the roadway design, those practices are previously established for each organization. WisDOT QC process consists of 4 steps: 1) Confirm corridor surfaces are defined by corridor feature lines, not corridor links. 2) Confirm refinement surfaces are used to generate section views for plan sheet development. 3) Visually inspect each surface model, looking for abnormalities such as: spikes, waterfalls, vertical link triangulation issues, choppy rippled surface construction.	refinement surface-miles	0.5	0.75	0.75-1	1	0.25 - 0.5	0.25 - 0.5*	*For QC review, I also include: 1. Check for crossing or duplicate breaklines 2. Confirm that the appropriate breaklines are included with their respective surface models 3. Check that the proper frequency spacing has been used 4. Documentation, correspondence, and comment forms to complete the review/designer response/confirm & backcheck that comments have been addressed.	Y	25	75	
18	Extract breaklines from refinement surface sources	Need to include the breaklines within gradings area and feature lines added to refinement surfaces as breaklines.												100
18a		Grading area where surface triangles are delivered as breaklines. Example: Rural Driveways and Curb Ramps	surfaces	0.5	0.5	0.5	0.5	0.5	0.5	all objects in a single dwg file, export to acad, explode, export to acad or copy	N			100
18b		Grading area where true breaklines are delivered. Example: Ponds	surfaces	0.25	0.25	0.25	0.25	0.25 - 0.5	0.25 - 0.5	saveas-explode-exportacad or copy	N			100
18c		Urban driveways that need additional design consideration because of significant changes in grade for TOP and DATUM breaklines	surfaces	0.25	0.25	0.25	0.25	0.25	0.25	deep cut, high fill, significant terrain change driveways - those that are designed in the corridor will have breaklines from corridor	N			100
18d		Breaklines added directly to the TOP and DATUM refinement surfaces	refinement surfaces	0.5	0.5	0.5	0.5	0.5 - 0.75	0.5	don't forget some feature lines may need to be weeded out	N			100
19	3D Surface Model Delivery Files	This is the package of files delivered to the contractor												100
19a	*Surfaces:*	The 3D surface is required. The surface can be utilized by the contract directly for AMG, or be used to communicated design intent.	refinement surfaces	0.25	0.25	0.25	0.25	0.25 - 0.5	0.25 - 0.5		N			100
19b	*Longitudinal Breaklines (Base and Subbase):*	Extract longituinal breaklines from corridor sources. Contractors desire the surface building blocks, not necessarily the surfaces. This gives them the flexibility to manipulate the model to fit their own workflows. Base and subbase surfaces have been separated because the task is less complex.	corridor surfaces	0.25	0.25	0.25	0.25	0.5*	0.5	*Do not forget about Quality Control. Project complexity plays a part.	N			100
19c	*Longitudinal Breaklines (Top and Datum):*	Extract longituinal breaklines from corridor sources. Add in breaklines from non corridor sources captured in task 18. Contractors desire the surface building blocks, not necessarily the surfaces. This gives them the flexibility to manipulate the model to fit their own workflows.	corridor surfaces	0.5	0.5	0.5	0.5	0.5 - 0.75	0.5 - 0.75		N			100
19d	*Alignment and Profile documents:*	Alignments and profiles are delivered with current workflow. No extra work.	-	not extra work	not extra work	not extra work	not extra work	not extra work	not extra work		N			100
19e	*Surface Boundaries:*	Surface boundaries are required to remove external triangulation.	refinement surfaces	0.25	0.25	0.25	0.25	0.25	0.25		N			100
19f	*Superelevation documents:*	Superelevation data is delivered with current workflow. No extra work.	-	not extra work	not extra work	not extra work	not extra work	not extra work	not extra work		N			100
19g	*Right of Way:*	Right of Way data is delivered with current workflow. No extra work.	-	not extra work	not extra work	not extra work	not extra work	not extra work	not extra work		N			100
19h	*Proposed Roadway Features:*	This a dwg file containing all of the proposed edglines (what is normally shown on the plan sheets).	design model packages	0.25	0.25	0.25	0.25	0.25	0.25		N			100
19i	*Existing Mapping:*	Mapping files are delivered with current workflow. No extra work.	-	not extra work	not extra work	not extra work	not extra work	not extra work	not extra work		N			100
19j	*Metadata document:*	Documentation of package contents	design model packages	1	1	1.75	1.5	2	2		N			100

*See Designer Task Force Report, Extra Work Element Characteristics section

Assumptions

-Comparing 2d designed in C3D vs 3d designed in C3D
-Experienced designer
-Experienced C3D user
-Corridor length = 1.5 mile
-Interchanges = diamond with 6 corridors
-Estimates reflect a single design iteration