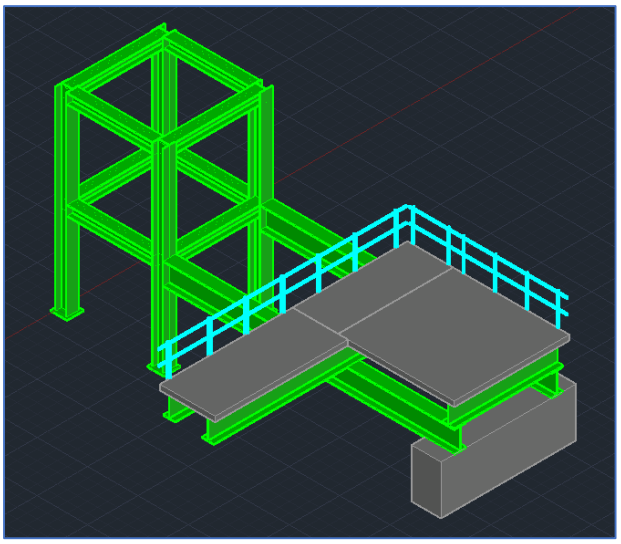
DESCRIPTION

This add-in (CG-testing.DVB, as of December 2019) for AutoCAD (tested on AutoCAD 2018) is used to locate the Center of Gravity of a 3D model, composed of a single or mixture of material elements.



Note that this add-in only works with 3D solid elements (not 3D surfaces), as defined by AutoCAD.

And note that the VBA includes very limited error handling, right now.

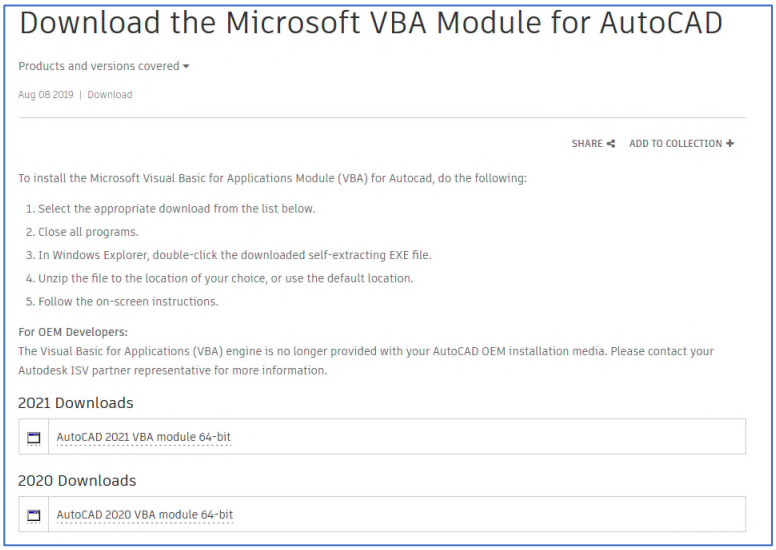
SETUP

Copy the *.DVB file from the office server to some location on your local drive:

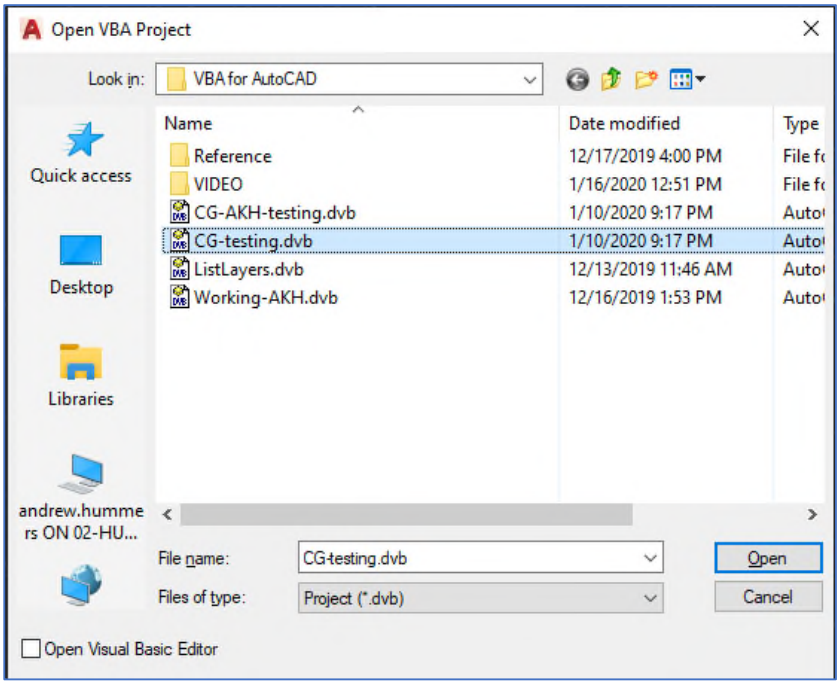
J:\Working – AKH

Also, this add-in was written in VBA. Autodesk no longer includes a VBA module with their standard AutoCAD distributions. To be able to use this add-in, go to the AutoCAD website and download the Microsoft VBA Module for AutoCAD:

https://knowledge.autodesk.com/support/autocad/downloads/caas/downloads/content/download-the-microsoft-vba-module-for-autocad.html

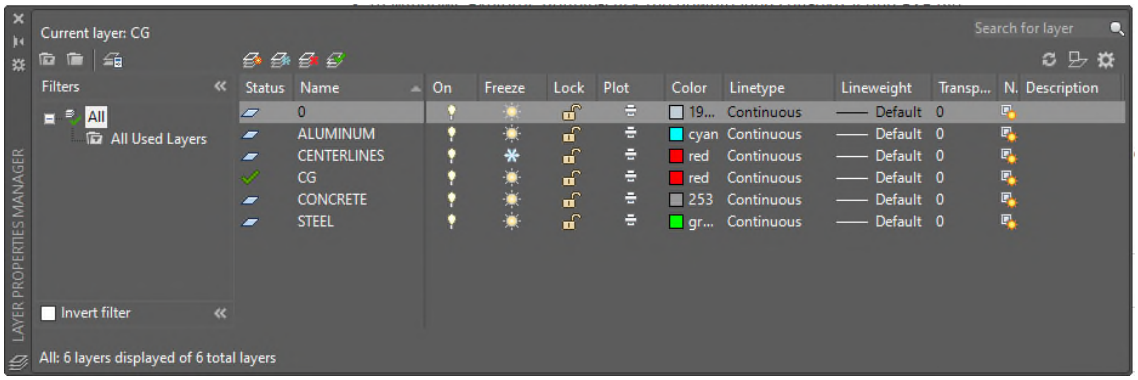


One the module is installed in AutoCAD, type the command **VBALOAD** and locate the DVB file on your local machine. Similar to LISP routines, this command just lets AutoCAD know where to find this add-in. This step may need to be repeated in each AutoCAD session (every time you restart AutoCAD).



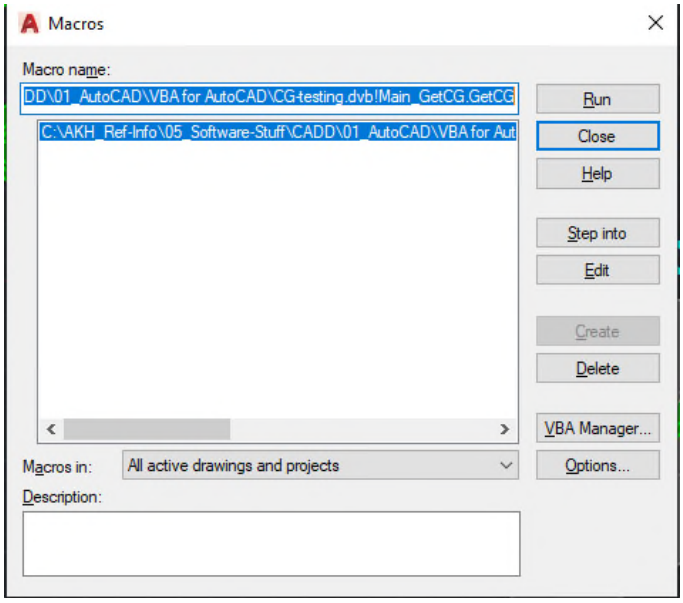
DRAWING SETUP – BEFORE RUNNING ADD-IN

The basic premise that this add-in works on is that each different material type is on a different layer. Actual layer / material names do not matter. As of right now, the material densities will be input by the user.

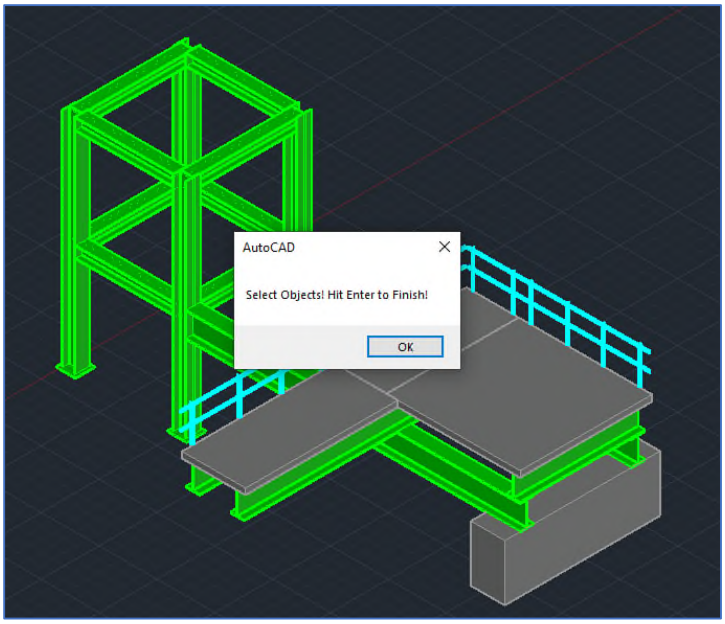


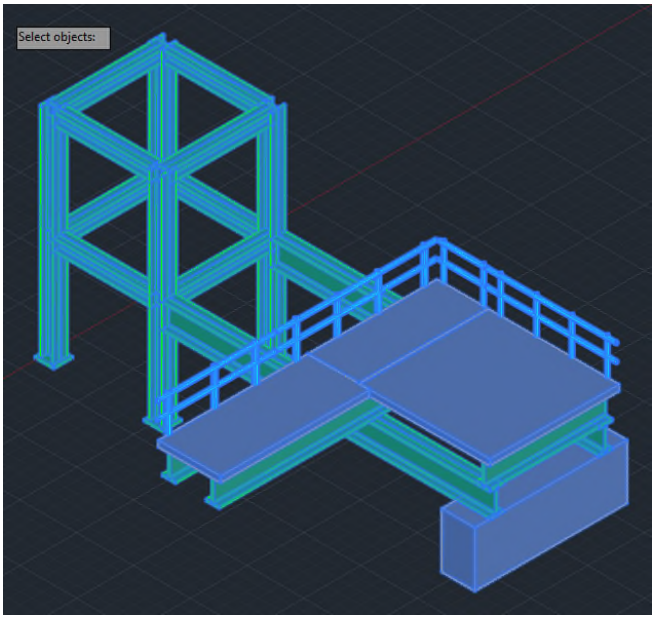
ADD-IN USE

Once the model / drawing is complete, with each 3D solid member on the layer that represents it's material type, enter the command **VBARUN**. Select the previously loaded VBA routine. And select "Run".



Select all of the 3D solid objects, of all different materials under consideration, and press “Enter”.

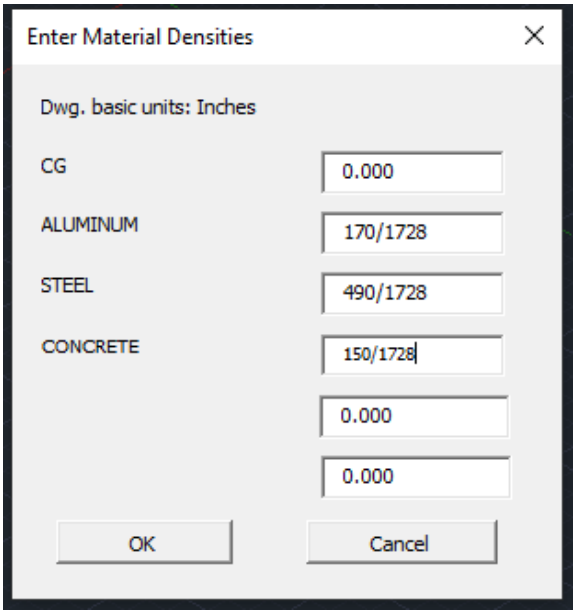




Next, an input box will appear, listing all of the layers of the selected objects, as well as noting what the basic drawing units are (inches or feet, for instance). Now the user must enter the material densities that are to be assigned to each layer.

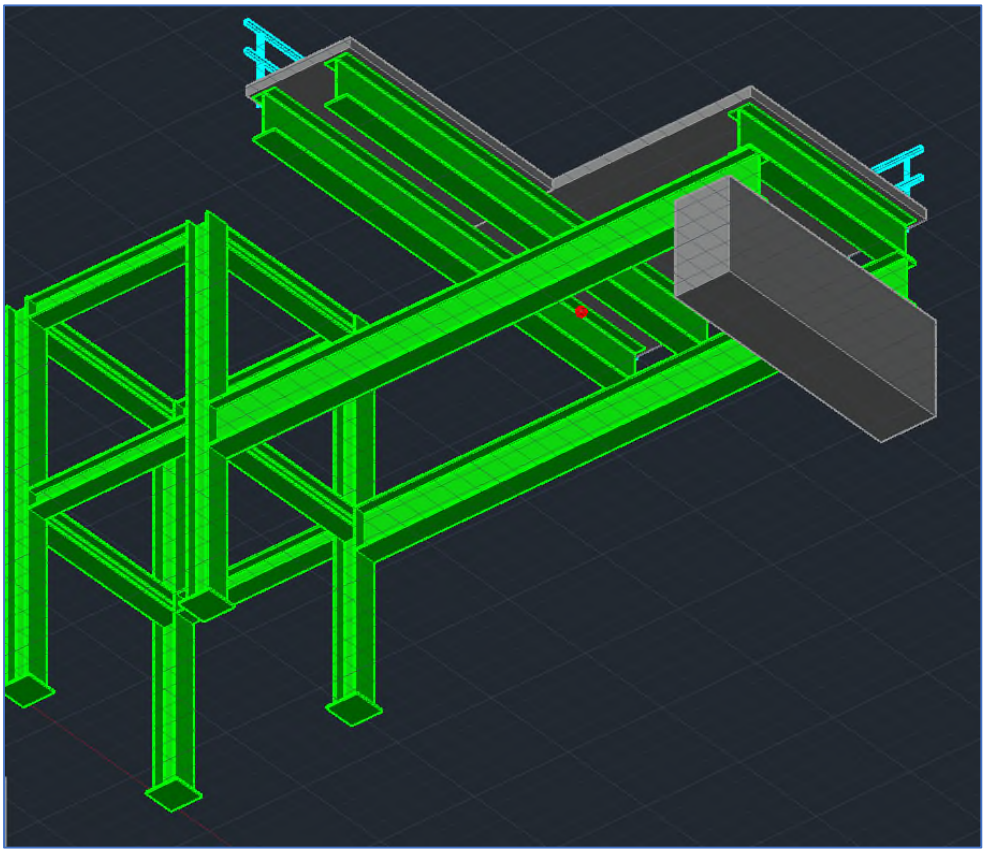
Right now, the add-in is only capable of handling 5 different layers / materials. If there are any layers that are of no interest, the unit density can just be entered as ZERO, so it will have no effect on the calculations.

Be aware of the units when entering. For instance Aluminum is typically 170 lb / ft^3, but the basic drawing units are in inches. So we have to divide 170 / (12^3 or 1728) to enter the aluminum weight as lb / in^3.



After the unit densities are entered and “OK” is pressed, you will be asked for a location to save the calculated output as a *.CSV (comma separated values) file that can later be used by Excel or other software. And then you are asked to indicate a file name for the CSV.

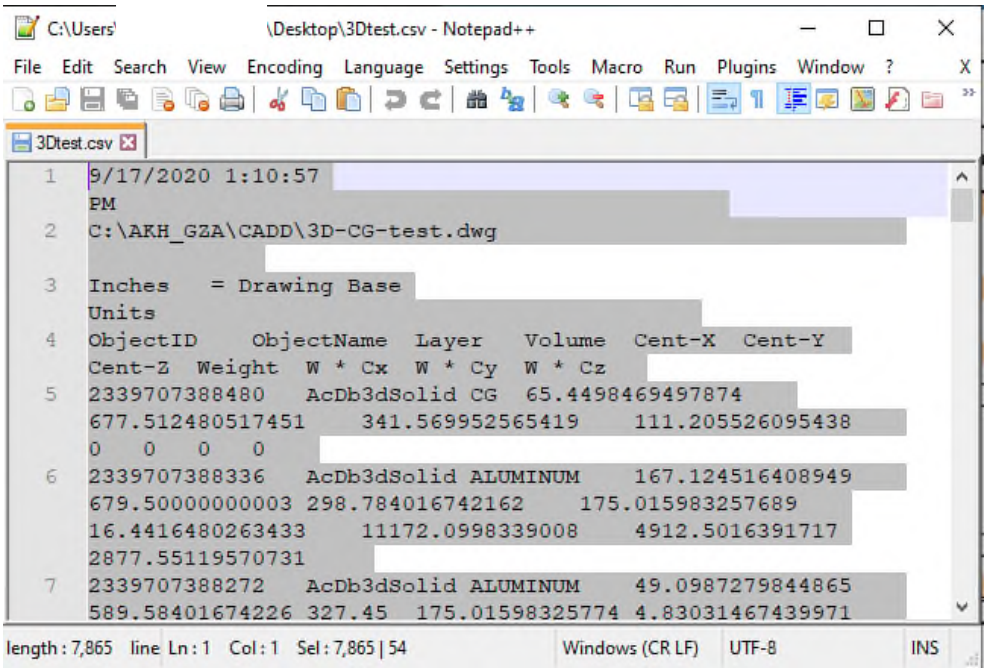
Then the VBA routine runs, a **RED** sphere is placed at the calculated Center of Gravity of your model, and the CSV file is created. Note that the **RED** sphere is placed at the calculated GLOBAL coordinates of the CG.



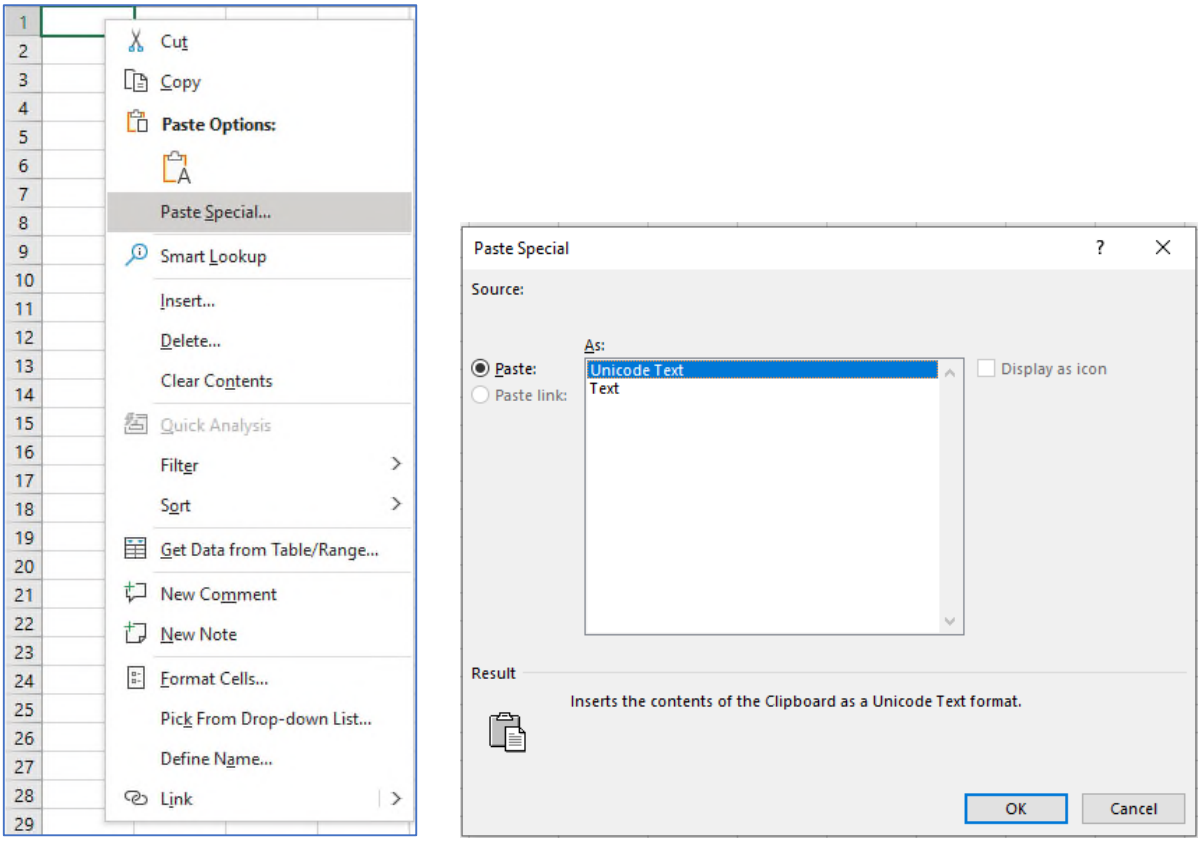
POST-PROCESSING - CSV

At present, the calculated data is saved as a *.CSV file, using a TAB delimiter between data fields. One way of viewing the data is to "manually" create an Excel table.

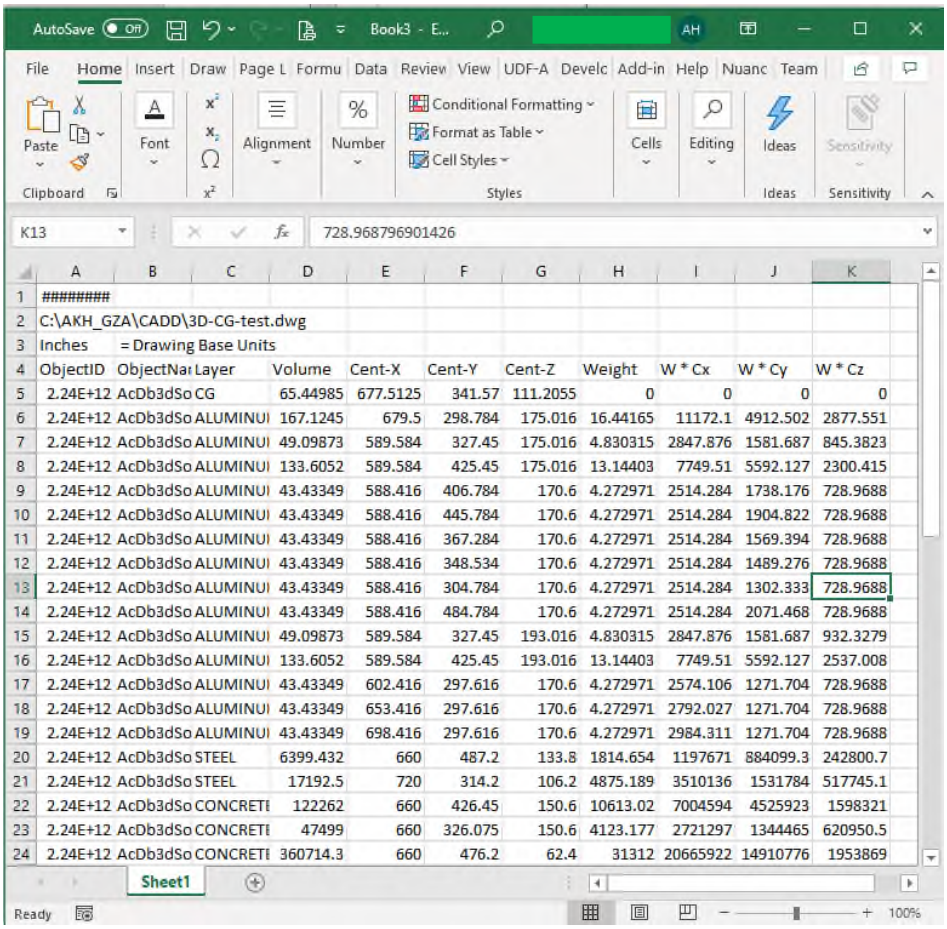
To do this, open the CSV file in a simple text editor like **Notepad** or **Notepad++**. Select all of the text and copy (Ctrl+C) it to the windows clipboard.



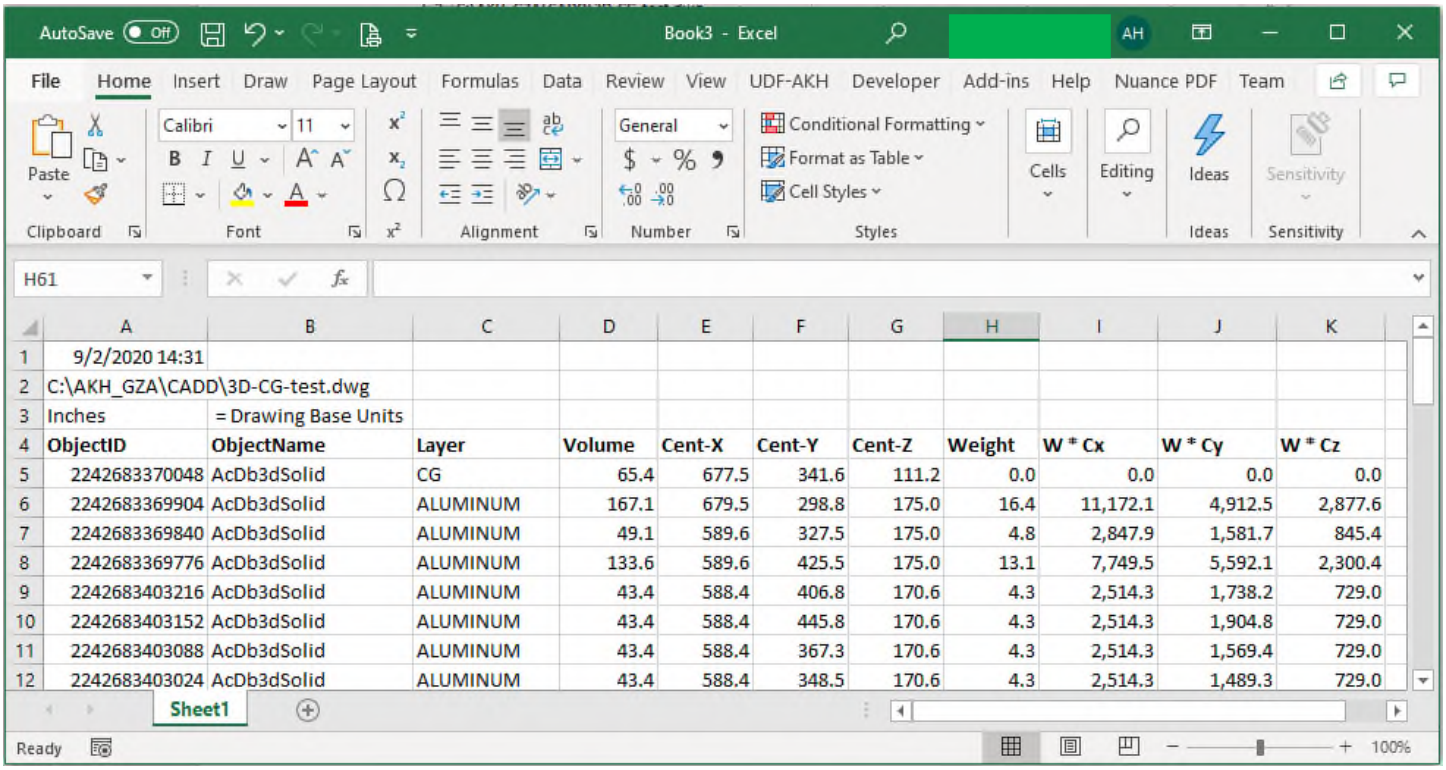
Then open a new **Excel** spreadsheet (or wherever you want to put the data). Right-click in a blank area and select "Unicode Text".



This will paste the raw data into Excel, but it is easily formatted and manipulated for your use.



	A	B	C	D	E	F	G	H	I	J	K
1	########										
2	C:\AKH_GZA\CADD\3D-CG-test.dwg										
3	Inches	= Drawing Base Units									
4	ObjectID	ObjectNa	Layer	Volume	Cent-X	Cent-Y	Cent-Z	Weight	W * Cx	W * Cy	W * Cz
5	2.24E+12	AcDb3dSo	CG	65.44985	677.5125	341.57	111.2055	0	0	0	0
6	2.24E+12	AcDb3dSo	ALUMINUI	167.1245	679.5	298.784	175.016	16.44165	11172.1	4912.502	2877.551
7	2.24E+12	AcDb3dSo	ALUMINUI	49.09873	589.584	327.45	175.016	4.830315	2847.876	1581.687	845.3823
8	2.24E+12	AcDb3dSo	ALUMINUI	133.6052	589.584	425.45	175.016	13.14403	7749.51	5592.127	2300.415
9	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	588.416	406.784	170.6	4.272971	2514.284	1738.176	728.9688
10	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	588.416	445.784	170.6	4.272971	2514.284	1904.822	728.9688
11	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	588.416	367.284	170.6	4.272971	2514.284	1569.394	728.9688
12	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	588.416	348.534	170.6	4.272971	2514.284	1489.276	728.9688
13	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	588.416	304.784	170.6	4.272971	2514.284	1302.333	728.9688
14	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	588.416	484.784	170.6	4.272971	2514.284	2071.468	728.9688
15	2.24E+12	AcDb3dSo	ALUMINUI	49.09873	589.584	327.45	193.016	4.830315	2847.876	1581.687	932.3279
16	2.24E+12	AcDb3dSo	ALUMINUI	133.6052	589.584	425.45	193.016	13.14403	7749.51	5592.127	2537.008
17	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	602.416	297.616	170.6	4.272971	2574.106	1271.704	728.9688
18	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	653.416	297.616	170.6	4.272971	2792.027	1271.704	728.9688
19	2.24E+12	AcDb3dSo	ALUMINUI	43.43349	698.416	297.616	170.6	4.272971	2984.311	1271.704	728.9688
20	2.24E+12	AcDb3dSo	STEEL	6399.432	660	487.2	133.8	1814.654	1197671	884099.3	242800.7
21	2.24E+12	AcDb3dSo	STEEL	17192.5	720	314.2	106.2	4875.189	3510136	1531784	517745.1
22	2.24E+12	AcDb3dSo	CONCRETI	122262	660	426.45	150.6	10613.02	7004594	4525923	1598321
23	2.24E+12	AcDb3dSo	CONCRETI	47499	660	326.075	150.6	4123.177	2721297	1344465	620950.5
24	2.24E+12	AcDb3dSo	CONCRETI	360714.3	660	476.2	62.4	31312	20665922	14910776	1953869



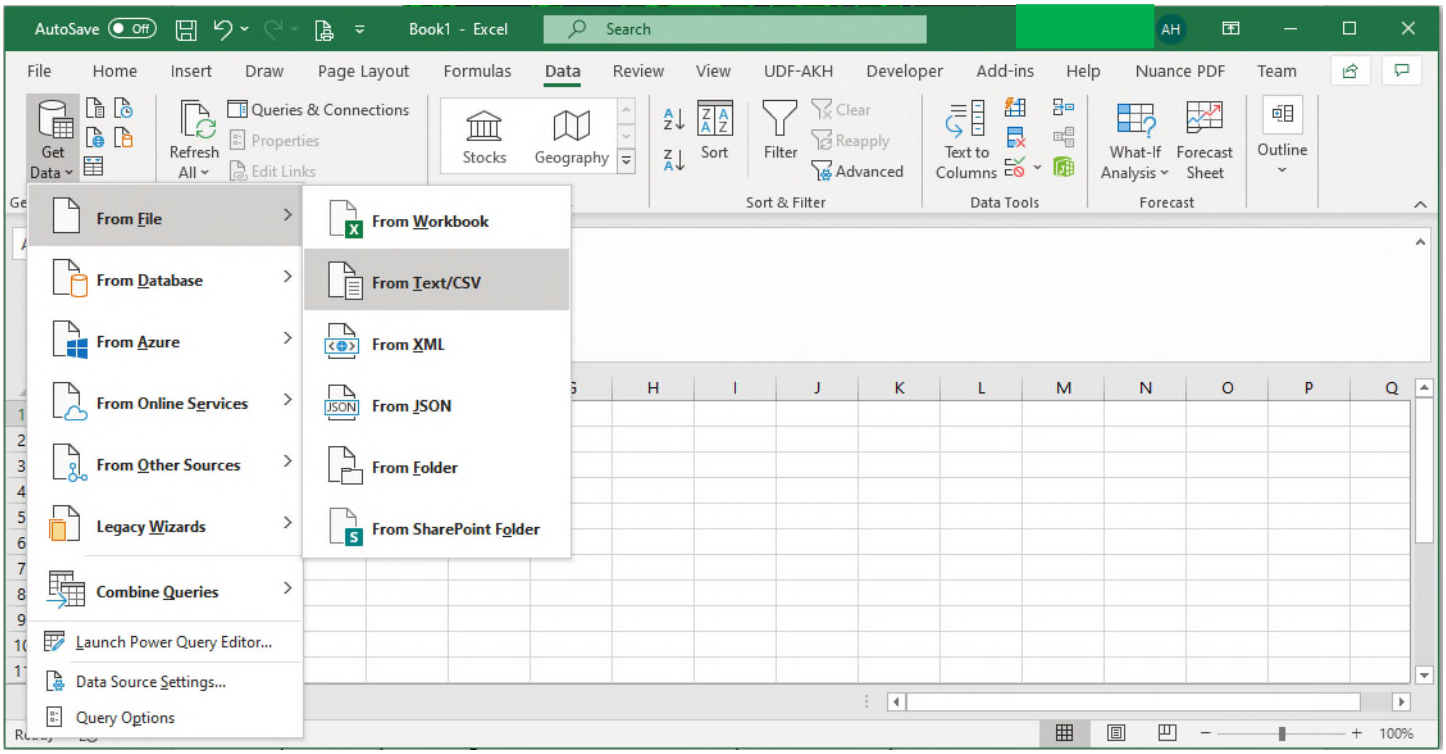
	A	B	C	D	E	F	G	H	I	J	K
1	9/2/2020 14:31										
2	C:\AKH_GZA\CADD\3D-CG-test.dwg										
3	Inches	= Drawing Base Units									
4	**ObjectID**	**ObjectName**	**Layer**	**Volume**	**Cent-X**	**Cent-Y**	**Cent-Z**	**Weight**	**W * Cx**	**W * Cy**	**W * Cz**
5	2242683370048	AcDb3dSolid	CG	65.4	677.5	341.6	111.2	0.0	0.0	0.0	0.0
6	2242683369904	AcDb3dSolid	ALUMINUM	167.1	679.5	298.8	175.0	16.4	11,172.1	4,912.5	2,877.6
7	2242683369840	AcDb3dSolid	ALUMINUM	49.1	589.6	327.5	175.0	4.8	2,847.9	1,581.7	845.4
8	2242683369776	AcDb3dSolid	ALUMINUM	133.6	589.6	425.5	175.0	13.1	7,749.5	5,592.1	2,300.4
9	2242683403216	AcDb3dSolid	ALUMINUM	43.4	588.4	406.8	170.6	4.3	2,514.3	1,738.2	729.0
10	2242683403152	AcDb3dSolid	ALUMINUM	43.4	588.4	445.8	170.6	4.3	2,514.3	1,904.8	729.0
11	2242683403088	AcDb3dSolid	ALUMINUM	43.4	588.4	367.3	170.6	4.3	2,514.3	1,569.4	729.0
12	2242683403024	AcDb3dSolid	ALUMINUM	43.4	588.4	348.5	170.6	4.3	2,514.3	1,489.3	729.0

Included in the CSV are the following fields for each 3D solid element, as well as the calculated sums, are as follows:

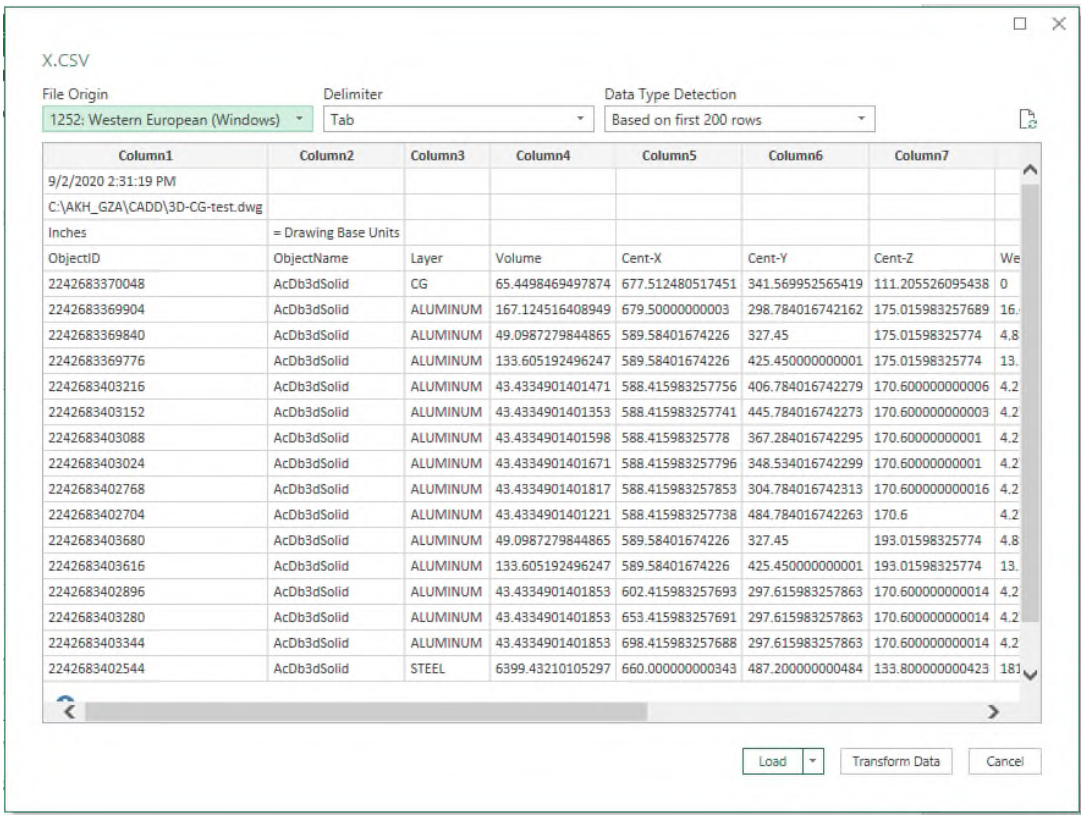
- AutoCAD's ObjectID
- AutoCAD's ObjectName (type)
- Object's Layer
- Object's Volume
- Object's Center of Gravity (CG) in the Global X,Y, and Z axes.
- Object's Weight (based on user entered unit density)
- Object's Weight * CG in each axes

ALTERNATIVE POST-PROCESSING - CSV

Another way of viewing the data is to use an automated Excel data table. Open a new Excel workbook. From the **Data** tab, select **Get Data →From File →From Text/CSV** and select the CSV file that was just created by AutoCAD.

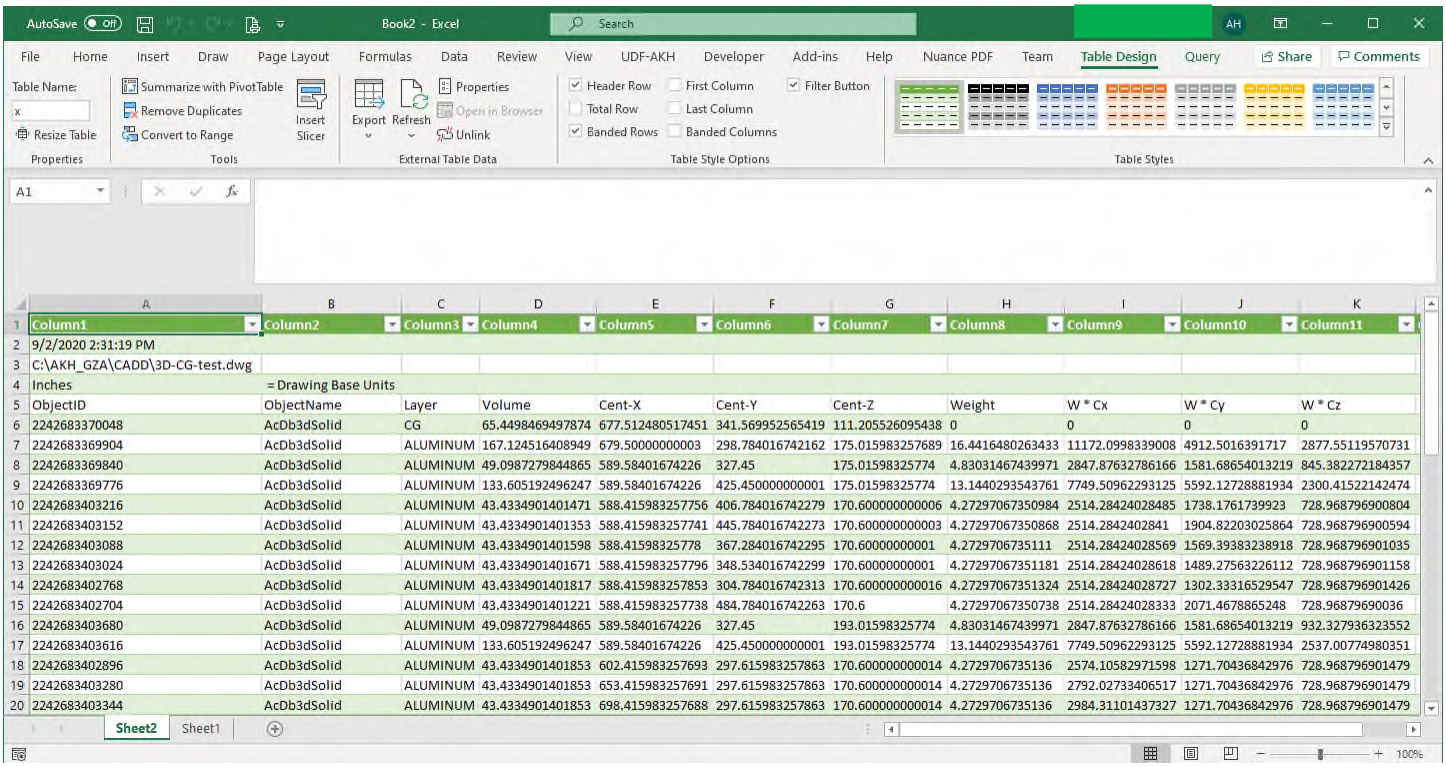


Make sure that **Tab** is selected as the delimiter and that the data columns appear to be correct. And select "Load".



Column1	Column2	Column3	Column4	Column5	Column6	Column7	
9/2/2020 2:31:19 PM							
C:\AKH_GZA\CADD\3D-CG-test.dwg							
Inches	= Drawing Base Units						
ObjectID	ObjectName	Layer	Volume	Cent-X	Cent-Y	Cent-Z	We
2242683370048	AcDb3dSolid	CG	65.4498469497874	677.512480517451	341.569952565419	111.205526095438	0
2242683369904	AcDb3dSolid	ALUMINUM	167.124516408949	679.50000000003	298.784016742162	175.015983257689	16.
2242683369840	AcDb3dSolid	ALUMINUM	49.0987279844865	589.58401674226	327.45	175.01598325774	4.8
2242683369776	AcDb3dSolid	ALUMINUM	133.605192496247	589.58401674226	425.450000000001	175.01598325774	13.
2242683403216	AcDb3dSolid	ALUMINUM	43.4334901401471	588.415983257756	406.784016742279	170.600000000006	4.2
2242683403152	AcDb3dSolid	ALUMINUM	43.4334901401353	588.415983257741	445.784016742273	170.600000000003	4.2
2242683403088	AcDb3dSolid	ALUMINUM	43.4334901401598	588.41598325778	367.284016742295	170.60000000001	4.2
2242683403024	AcDb3dSolid	ALUMINUM	43.4334901401671	588.415983257796	348.534016742299	170.60000000001	4.2
2242683402768	AcDb3dSolid	ALUMINUM	43.4334901401817	588.415983257853	304.784016742313	170.600000000016	4.2
2242683402704	AcDb3dSolid	ALUMINUM	43.4334901401221	588.415983257738	484.784016742263	170.6	4.2
2242683403680	AcDb3dSolid	ALUMINUM	49.0987279844865	589.58401674226	327.45	193.01598325774	4.8
2242683403616	AcDb3dSolid	ALUMINUM	133.605192496247	589.58401674226	425.450000000001	193.01598325774	13.
2242683402896	AcDb3dSolid	ALUMINUM	43.4334901401853	602.415983257693	297.615983257863	170.600000000014	4.2
2242683403280	AcDb3dSolid	ALUMINUM	43.4334901401853	653.415983257691	297.615983257863	170.600000000014	4.2
2242683403344	AcDb3dSolid	ALUMINUM	43.4334901401853	698.415983257688	297.615983257863	170.600000000014	4.2
2242683402544	AcDb3dSolid	STEEL	6399.43210105297	660.000000000343	487.200000000484	133.800000000423	181

This will create a query table in Excel, which (in my opinion) can be difficult to format and work with.



	A	B	C	D	E	F	G	H	I	J	K
1	Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11
2	9/2/2020 2:31:19 PM										
3	C:\AKH_GZA\CADD\3D-CG-test.dwg										
4	Inches	= Drawing Base Units									
5	ObjectID	ObjectName	Layer	Volume	Cent-X	Cent-Y	Cent-Z	Weight	W * Cx	W * Cy	W * Cz
6	2242683370048	AcDb3dSolid	CG	65.4498469497874	677.512480517451	341.569952565419	111.205526095438	0	0	0	0
7	2242683369904	AcDb3dSolid	ALUMINUM	167.124516408949	679.50000000003	298.784016742162	175.015983257689	16.4416480263433	11172.0998339008	4912.5016391717	2877.55119570731
8	2242683369840	AcDb3dSolid	ALUMINUM	49.0987279844865	589.58401674226	327.45	175.01598325774	4.83031467439971	2847.87632786166	1581.68654013219	845.382272184357
9	2242683369776	AcDb3dSolid	ALUMINUM	133.605192496247	589.58401674226	425.450000000001	175.01598325774	13.1440293543761	7749.50962293125	5592.12728881934	2300.41522142474
10	2242683403216	AcDb3dSolid	ALUMINUM	43.4334901401471	588.415983257756	406.784016742279	170.600000000006	4.27297067350984	2514.28424028485	1738.1761739923	728.968796900804
11	2242683403152	AcDb3dSolid	ALUMINUM	43.4334901401353	588.415983257741	445.784016742273	170.600000000003	4.27297067350868	2514.2842402841	1904.82203025864	728.968796900594
12	2242683403088	AcDb3dSolid	ALUMINUM	43.4334901401598	588.41598325778	367.284016742295	170.60000000001	4.2729706735111	2514.28424028569	1569.39383238918	728.968796901035
13	2242683403024	AcDb3dSolid	ALUMINUM	43.4334901401671	588.415983257796	348.534016742299	170.60000000001	4.27297067351181	2514.28424028618	1489.27563226112	728.968796901158
14	2242683402768	AcDb3dSolid	ALUMINUM	43.4334901401817	588.415983257853	304.784016742313	170.600000000016	4.27297067351324	2514.28424028727	1302.33316529547	728.968796901426
15	2242683402704	AcDb3dSolid	ALUMINUM	43.4334901401221	588.415983257738	484.784016742263	170.6	4.27297067350738	2514.28424028333	2071.4678865248	728.96879690036
16	2242683403680	AcDb3dSolid	ALUMINUM	49.0987279844865	589.58401674226	327.45	193.01598325774	4.83031467439971	2847.87632786166	1581.68654013219	932.327936323552
17	2242683403616	AcDb3dSolid	ALUMINUM	133.605192496247	589.58401674226	425.450000000001	193.01598325774	13.1440293543761	7749.50962293125	5592.12728881934	2537.00774980351
18	2242683402896	AcDb3dSolid	ALUMINUM	43.4334901401853	602.415983257693	297.615983257863	170.600000000014	4.2729706735136	2574.10582971598	1271.70436842976	728.968796901479
19	2242683403280	AcDb3dSolid	ALUMINUM	43.4334901401853	653.415983257691	297.615983257863	170.600000000014	4.2729706735136	2792.02733406517	1271.70436842976	728.968796901479
20	2242683403344	AcDb3dSolid	ALUMINUM	43.4334901401853	698.415983257688	297.615983257863	170.600000000014	4.2729706735136	2984.31101437327	1271.70436842976	728.968796901479

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