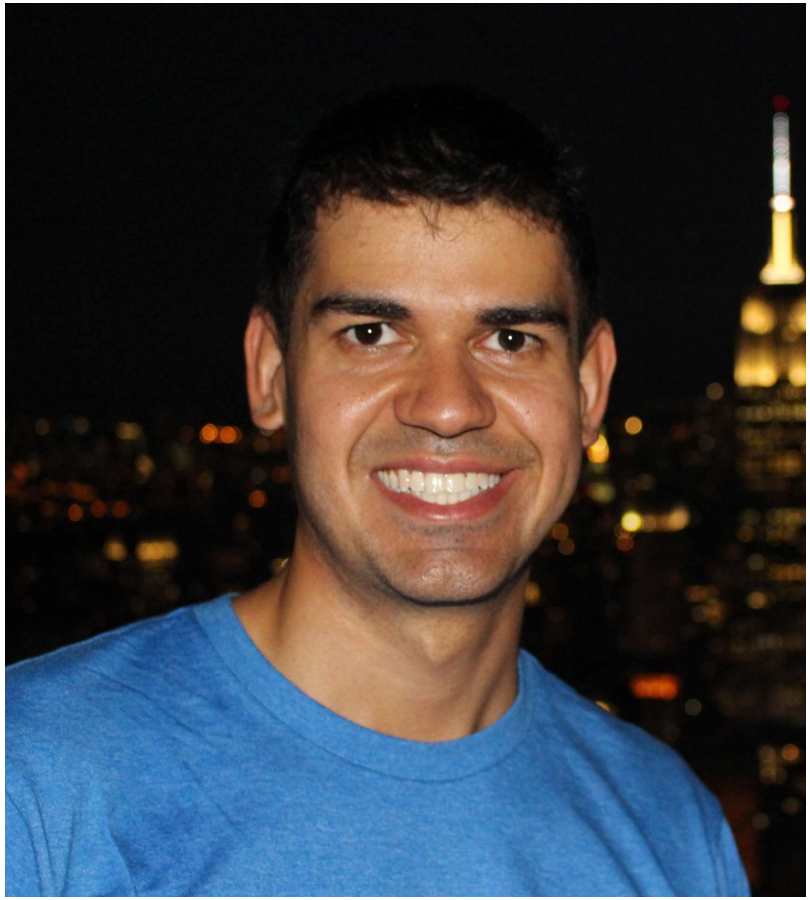
AUTODESK. UNIVERSITY

Pipe networks design in high density underground infrastructure environment

Halan Oliveira

Drainage Design Engineer | @halanoliveira



Halan Oliveira

Drainage design engineer

Brazilian Army officer

BIM Manager

1st Brazilian Public Administration/BIM Award Winner in 2018

Finalist of the Autodesk AEC Excellence Awards 2019

Cooker and guitar player

linkedin.com/in/halanoliveira/

Agenda

THE AUDIENCE

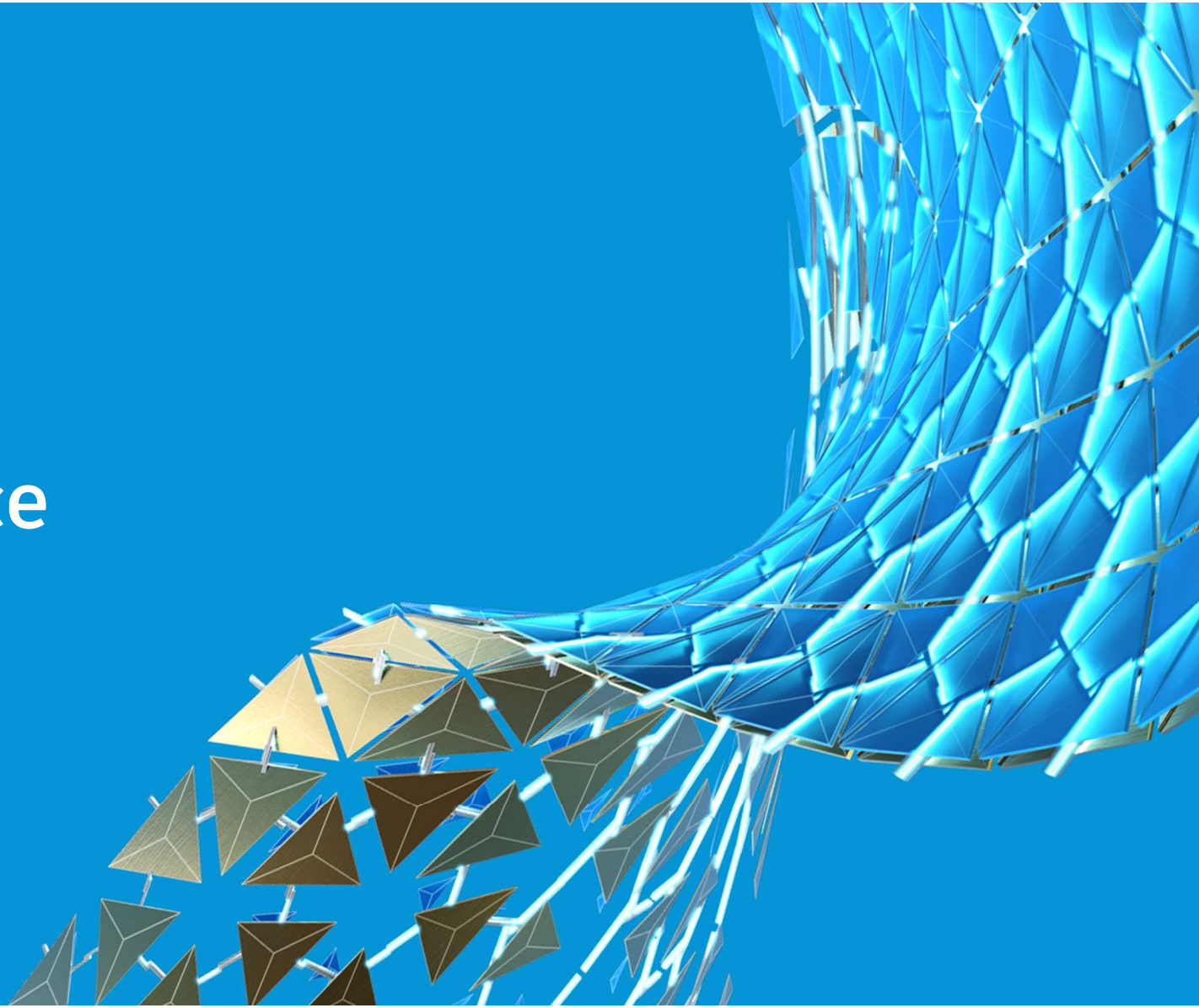
INTRODUCTION

4 LEARNING OBJECTIVES

- MODEL A DRAINAGE SYSTEM USING CIVIL 3D AND DYNAMO
- SWAP MULTIPLE NETWORK PARTS WITH DYNAMO
- RUN INTERFERENCE CHECK
- SOLVE INTERFERENCES BETWEEN TWO NETWORKS

CONCLUSION

The audience



The audience for this class

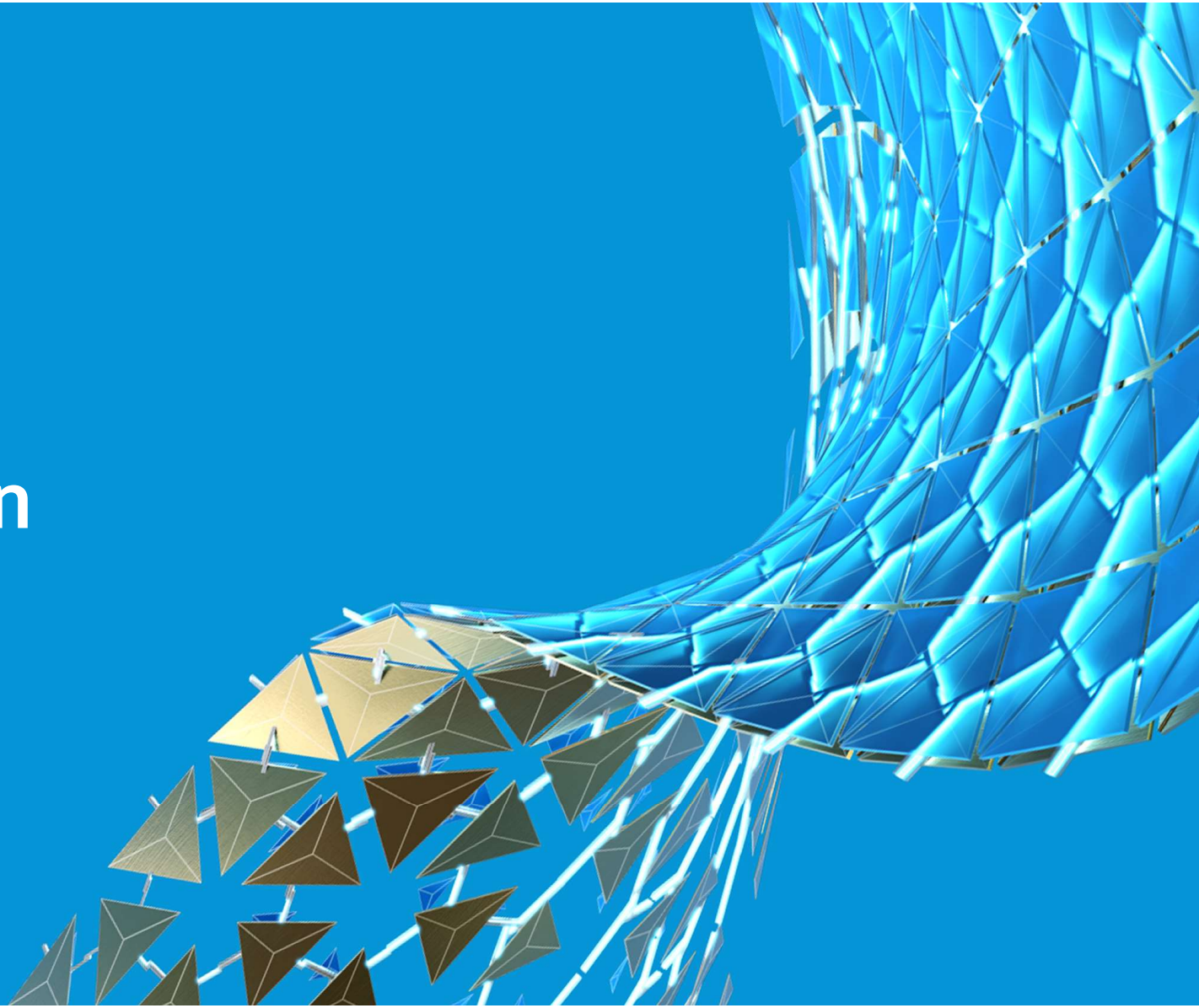
Drainage engineers

Design engineers

Land surveyors

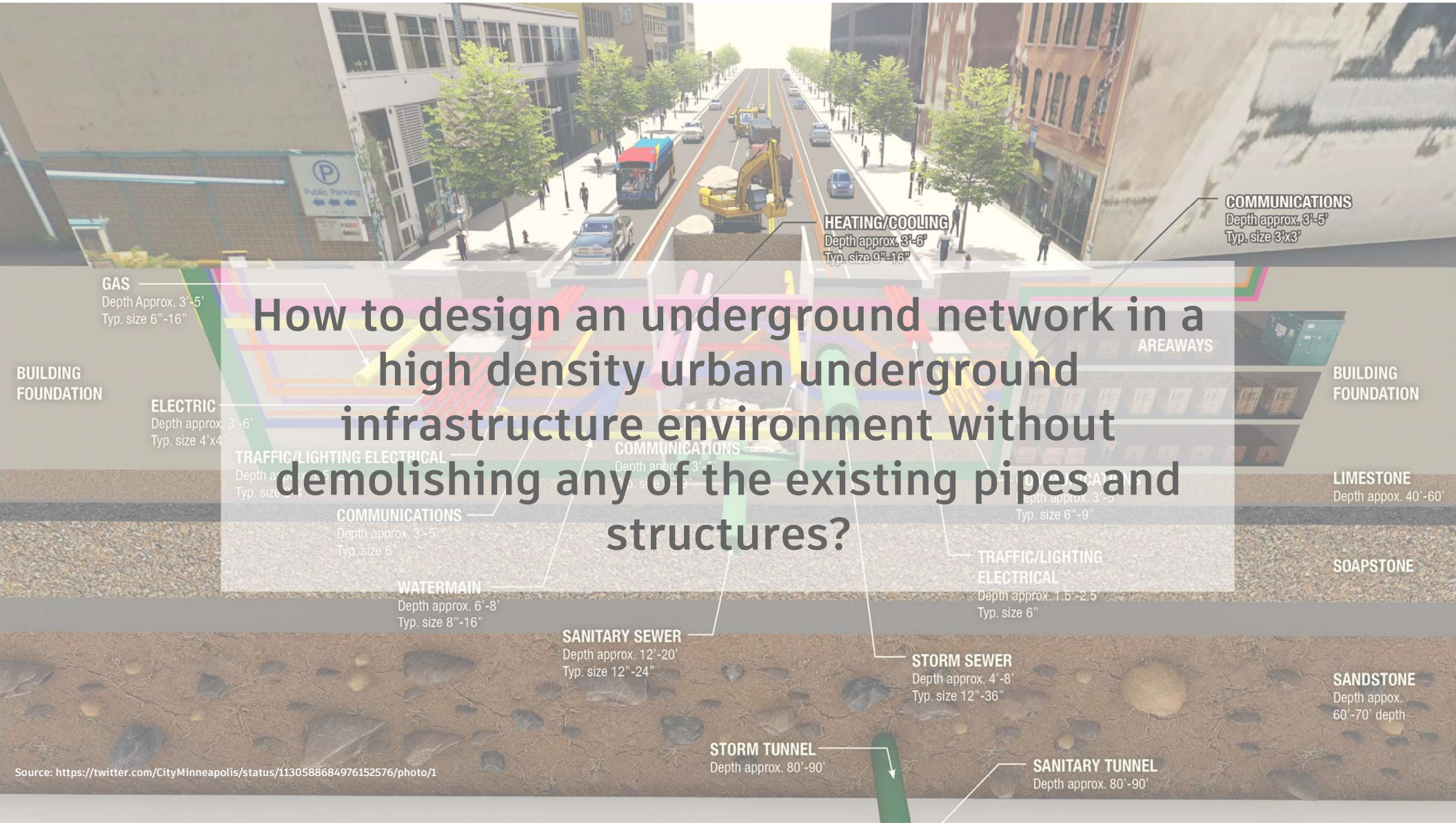
Dynamo users

Introduction



“Those who can imagine anything, can create the impossible.”

ALAN TURING, FATHER OF THE COMPUTER SCIENCE

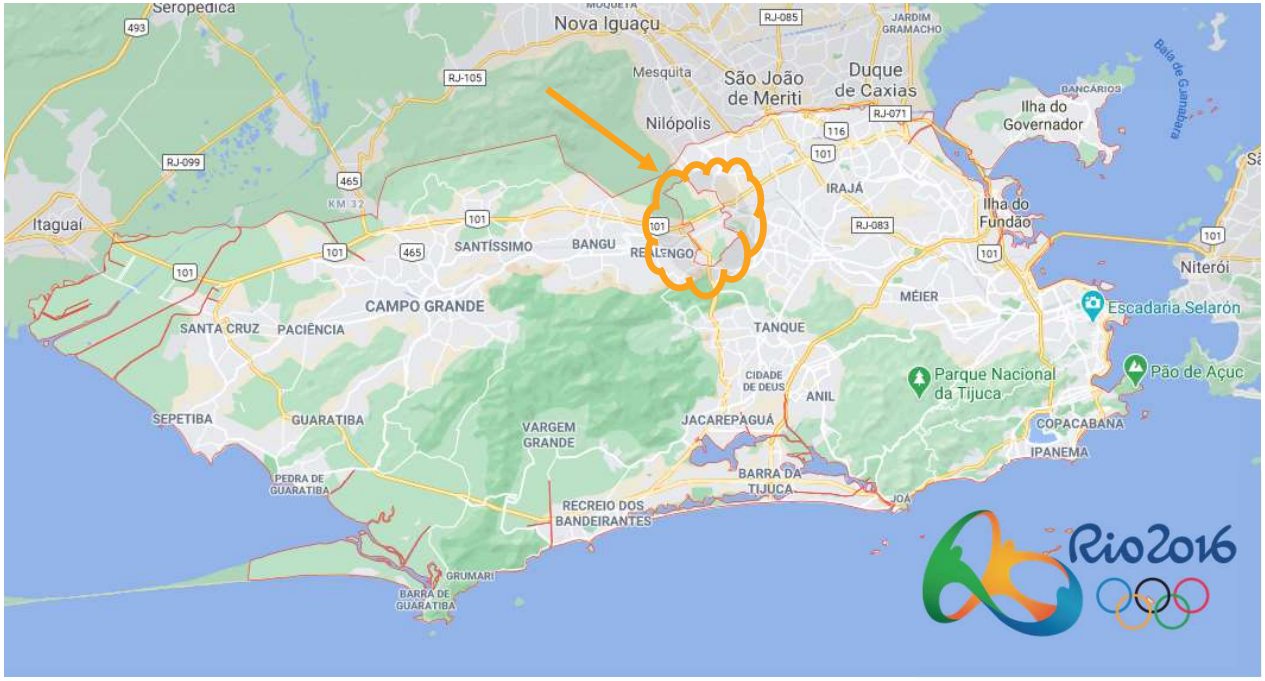


How to design an underground network in a high density urban underground infrastructure environment without demolishing any of the existing pipes and structures?

Source: https://twitter.com/CityMinneapolis/status/1130588684976152576/photo/1

A real case in Rio de Janeiro

- Military District of Rio de Janeiro
- 450 ha (1.74 sq.mi)
- Underground infrastructure built before World War I
- No blueprints being left for the next generations
- Rio 2016
- A project to build new sanitary sewers and storm network



A real case in Rio de Janeiro

A real case in Rio de Janeiro

Redshift by AUTODESK

Brazilian Army Battles Pollution in Rio's Toxic Guanabara Bay Using BIM

Brazilian Army Battles Pollution in Rio's Toxic Guanabara Bay Using BIM

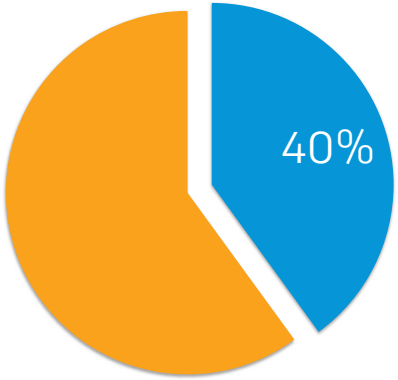
BY MATT ALDERTON INFRASTRUCTURE - MAR 19 2020 - 6 MIN READ

https://redshift.autodesk.com/pollution-guanabara-bay/

AUTODESK. FREE TRIALS PRODUCTS SEARCH

CUSTOMER STORIES / TOP STORIES CUSTOMER STORY FINDER

https://www.autodesk.com/customer-stories/brazilian-army-underground-sewage-network

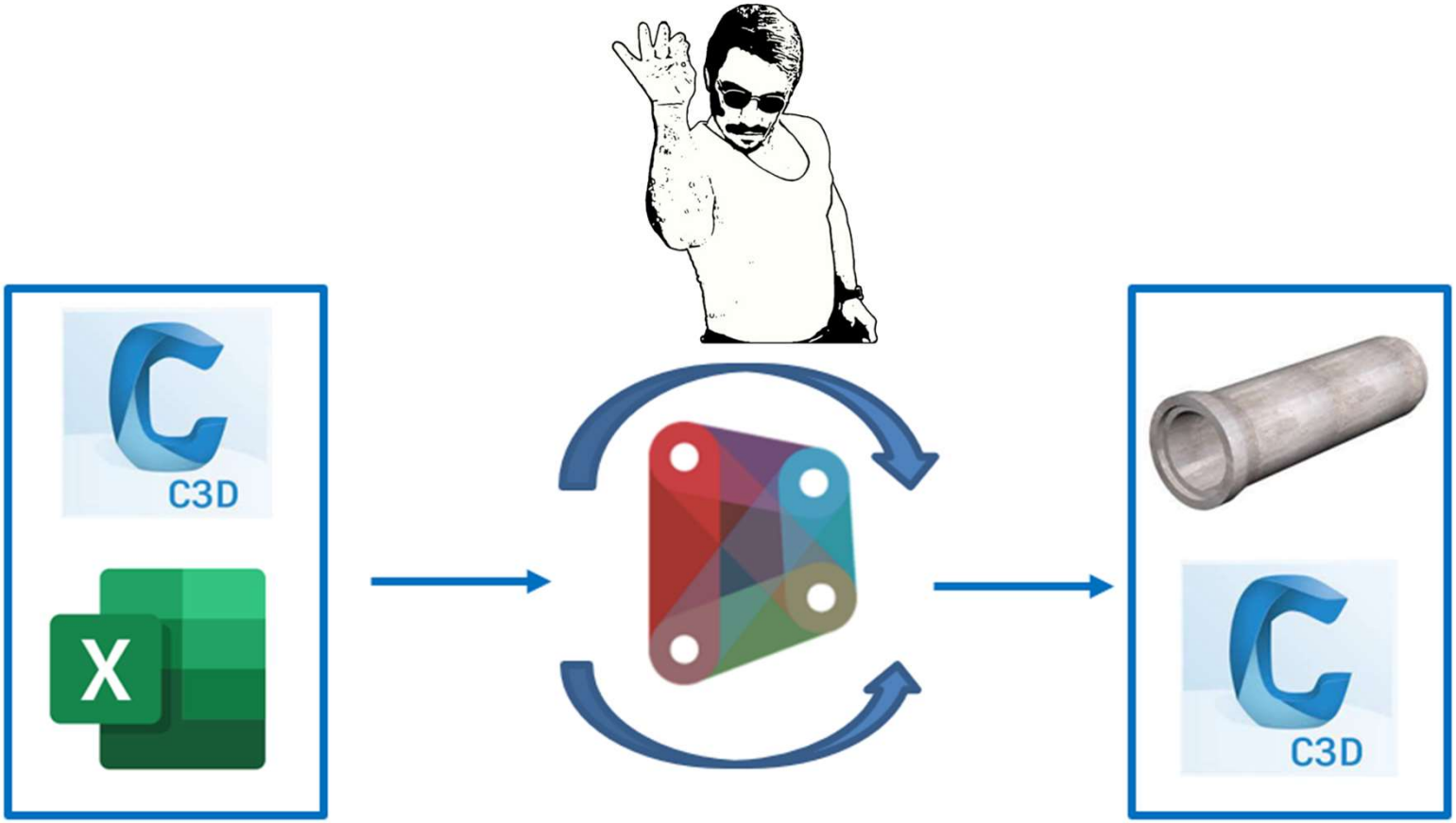


Savings New Budget

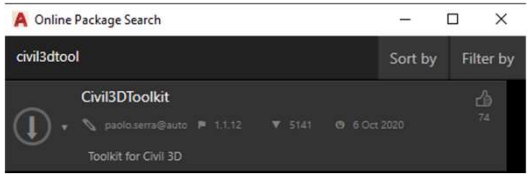
Dynamo for Civil 3D

Source: https://knowledge.autodesk.com/community/collection/dynamo-for-civil-3d-design-automation-infrastructure-projects

The Dynamo “touch”

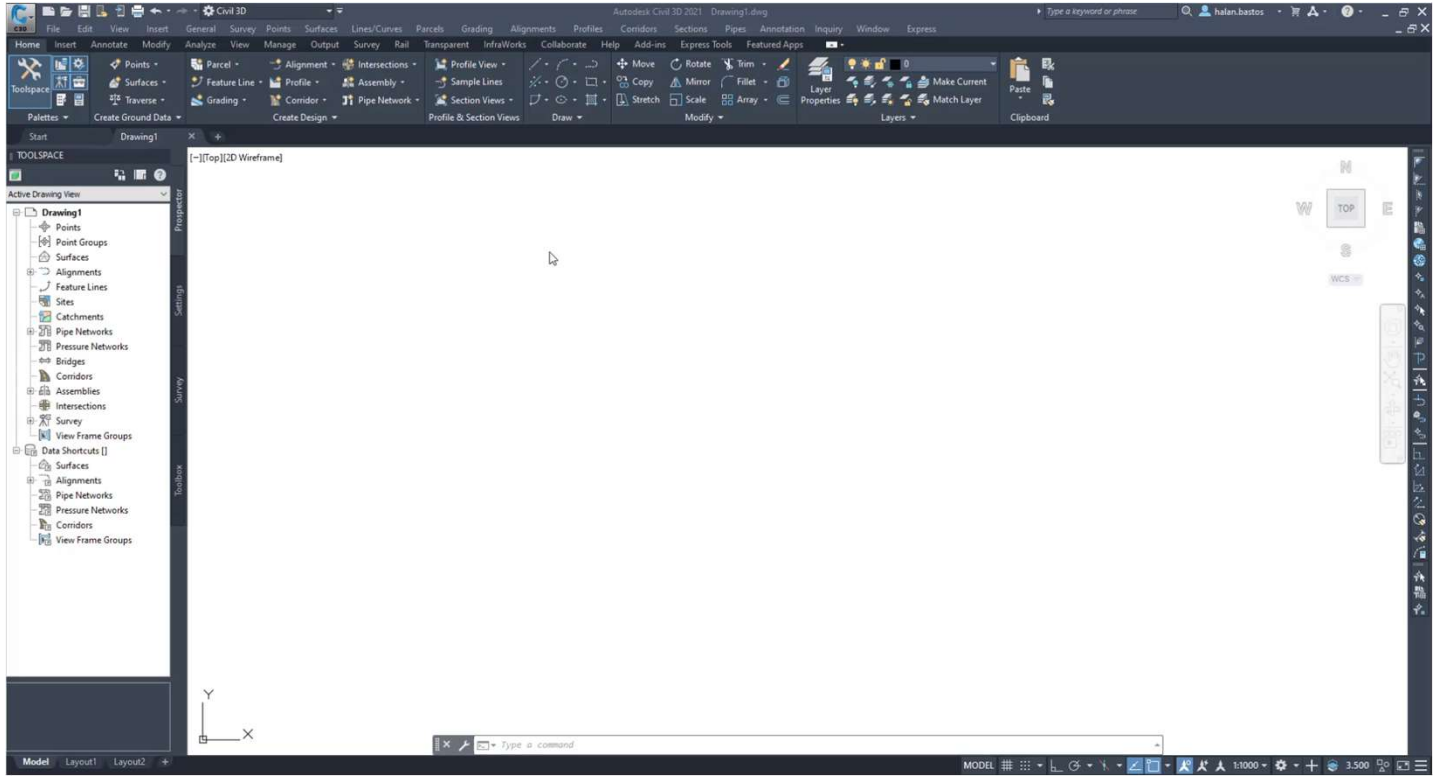


Before we started



Civil 3D Toolkit

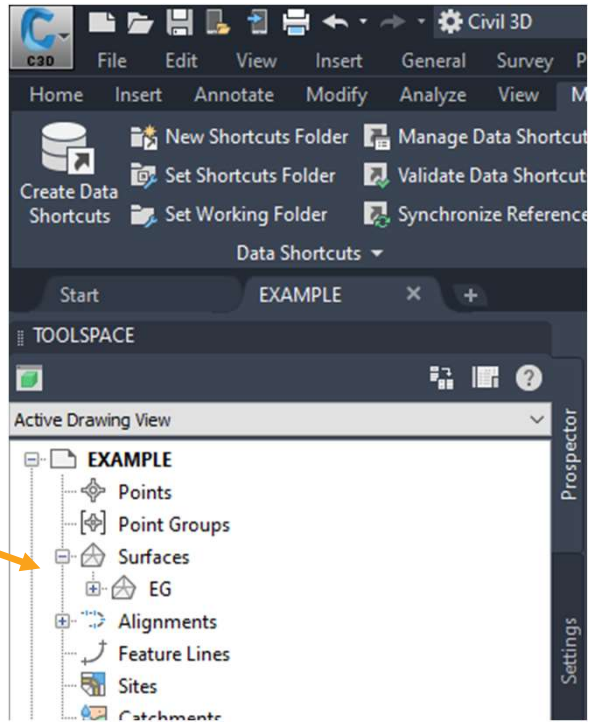
- Open source
- Interacts with Civil 3D entities and objects (alignments, parcels, pipe networks)
- https://forum.dynamobim.com/t/civil-3d-toolkit-feedback-thread/43570



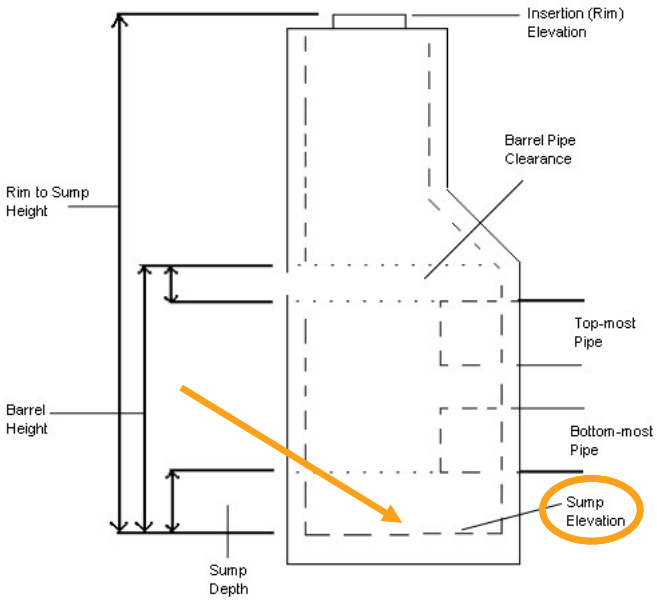
Link to the video: https://youtu.be/Xb4c4cmZjAk

Before we started

http://www.landinfo.com/GalDTM1mMecca.htm



Before we started



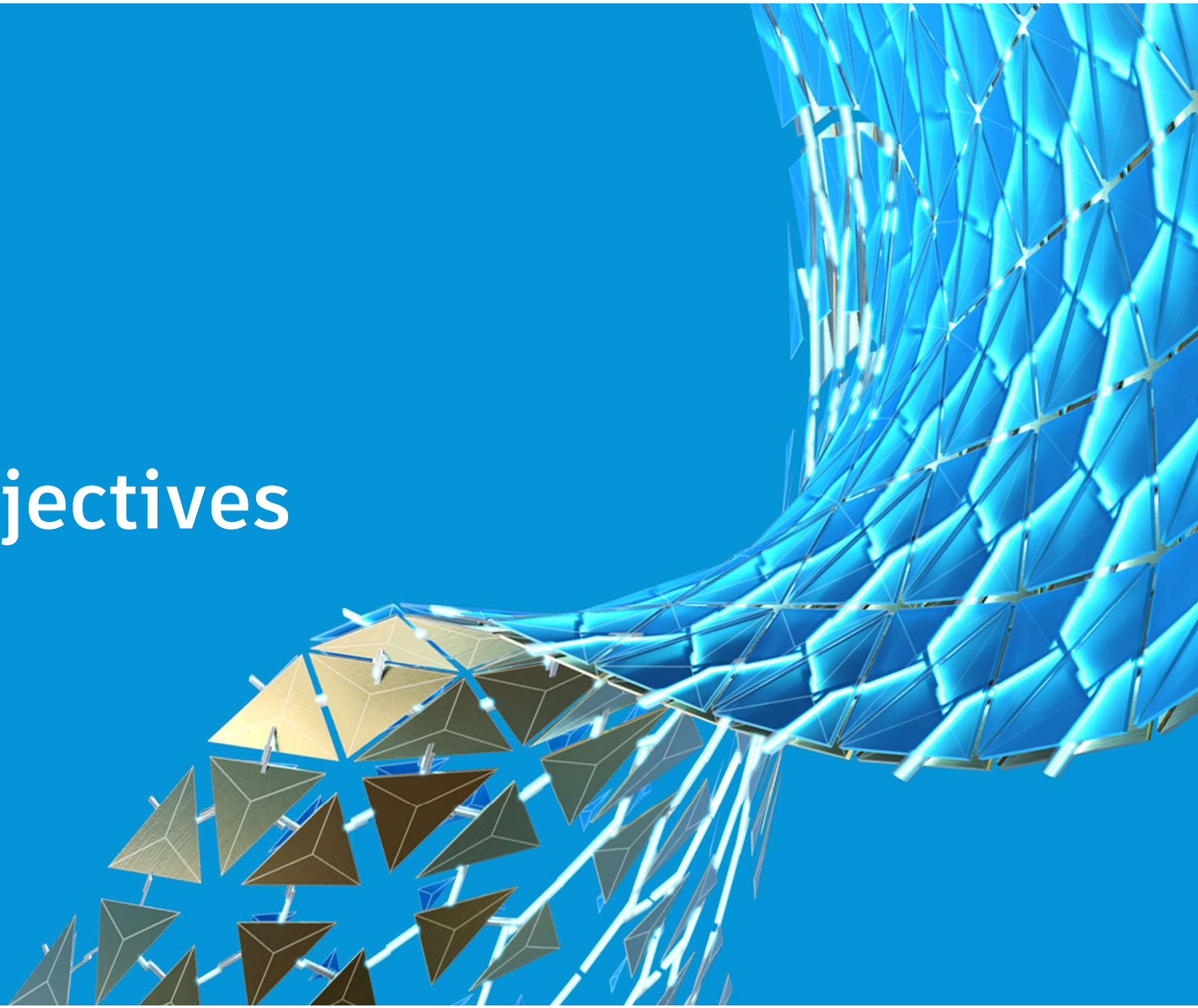
	A	B	C	D
1	NAME	SUMP ELEVATION	POSITION X	POSITION Y
2	MH 19	21.886	663,867.5228	7,470,488.9870
3	MH 20	21.734	663,860.3647	7,470,504.4064
4	MH 21	21.586	663,850.4812	7,470,519.7640
5	MH 22	21.427	663,844.4411	7,470,534.7370
6	MH 23	21.240	663,834.3360	7,470,553.7050
7	MH 24	21.003	663,823.7584	7,470,573.0490
8	MH 25	20.890	663,813.5387	7,470,590.2838
9	MH 26	20.620	663,800.5186	7,470,617.2763
10	MH 27	20.250	663,779.4114	7,470,653.2746
11	MH 28	20.109	663,766.7055	7,470,674.3686
12				

MANHOLES INLETS

	A	B	C	D
1	NAME	SUMP ELEVATION	POSITION X	POSITION Y
2	IN 12	21.921	663,865.8006	7,470,483.3554
3	IN 13	21.775	663,858.6143	7,470,497.1114
4	IN 14	21.855	663,865.6136	7,470,498.7967
5	IN 15	21.660	663,857.6347	7,470,514.4604
6	IN 16	21.575	663,843.2914	7,470,526.3395
7	IN 17	21.537	663,850.2615	7,470,528.7437
8	IN 18	21.282	663,831.7967	7,470,549.2579
9	IN 19	21.163	663,820.6675	7,470,569.9309
10	IN 20	21.093	663,814.0883	7,470,583.1947
11	IN 21	21.062	663,800.3873	7,470,609.4399
12				

MANHOLES INLETS

Learning objectives



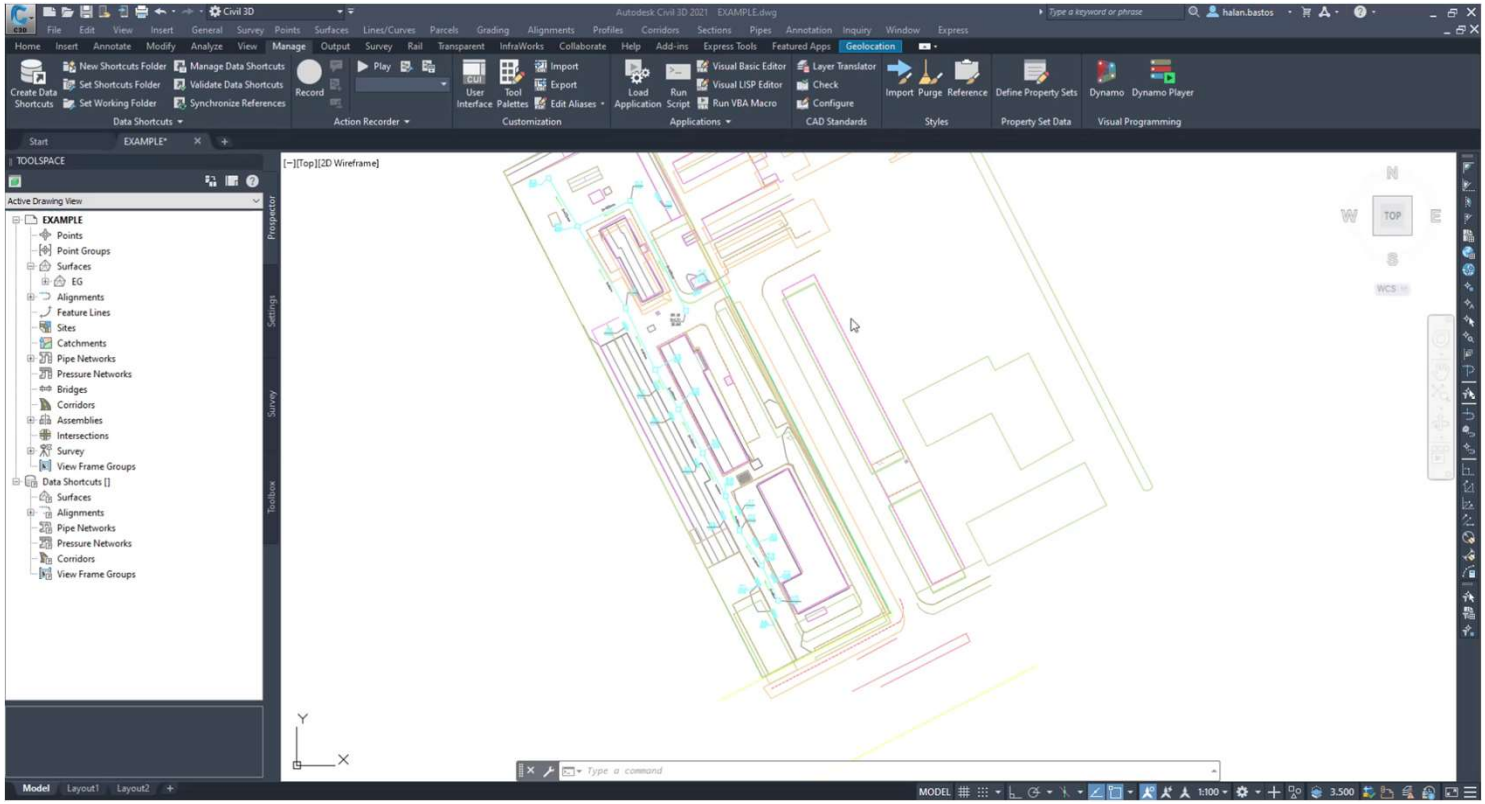
Pipe networks design in high density underground infrastructure environment

#1 MODELING	#2 SWAPPING	#3 INTERFERENCES	#4 SOLVING
Model a drainage system in a high density urban underground environment using Civil 3D and Dynamo	Swap network parts through Dynamo	Run interference check tool in Civil 3D	Solve interferences between two networks using Civil 3D

Dynamo player

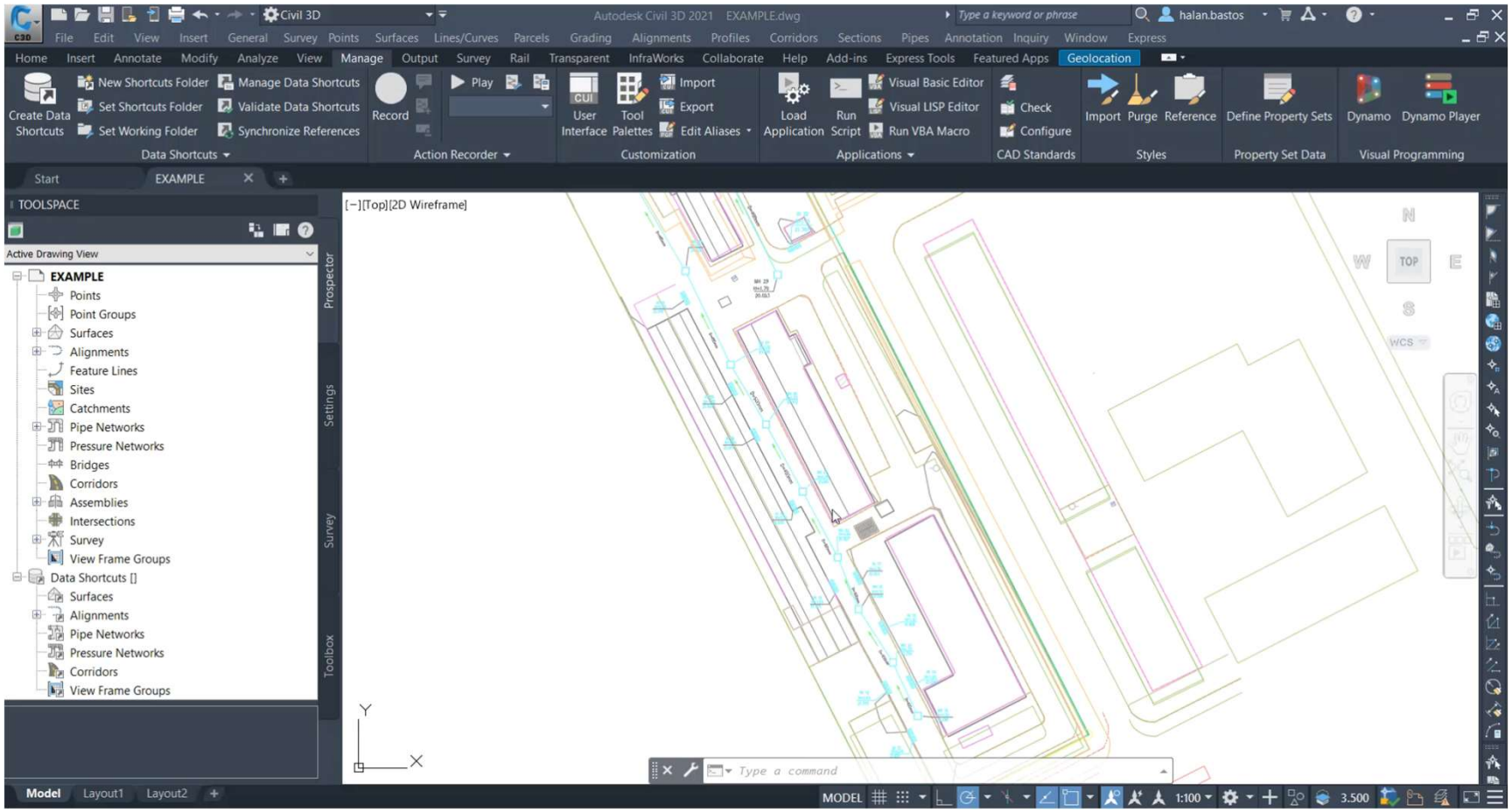
Provides:

- Default directory for scripts
- Filtering visible scripts
- Viewing the status of current scripts
- Launching a script
- Providing input for scripts
- Editing a script



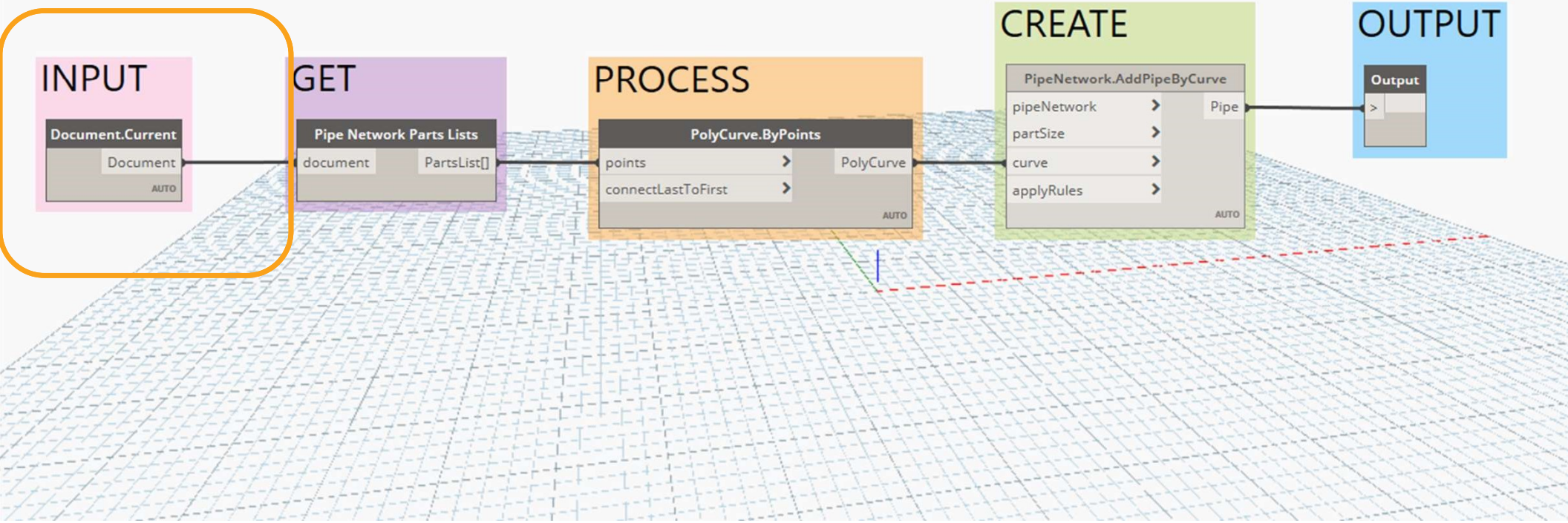
Link to the video: https://youtu.be/0Rk6uuhDY8s

Creation of a pipe network from Excel

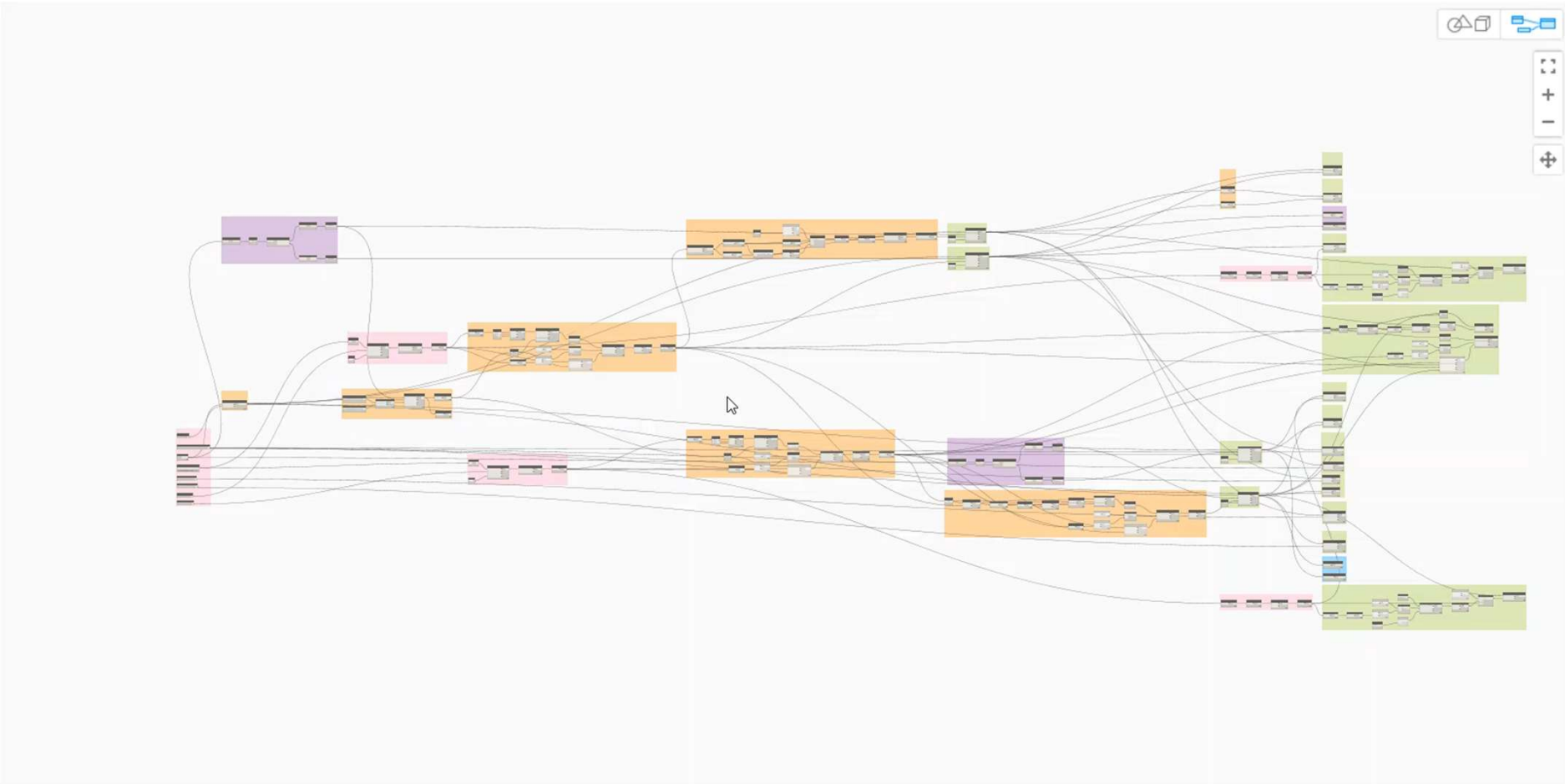


Link to the video: https://youtu.be/XuQ0saMs0Eg

Group color scheme

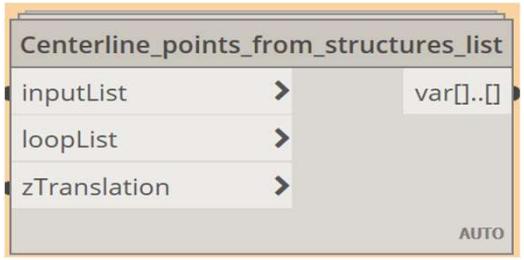


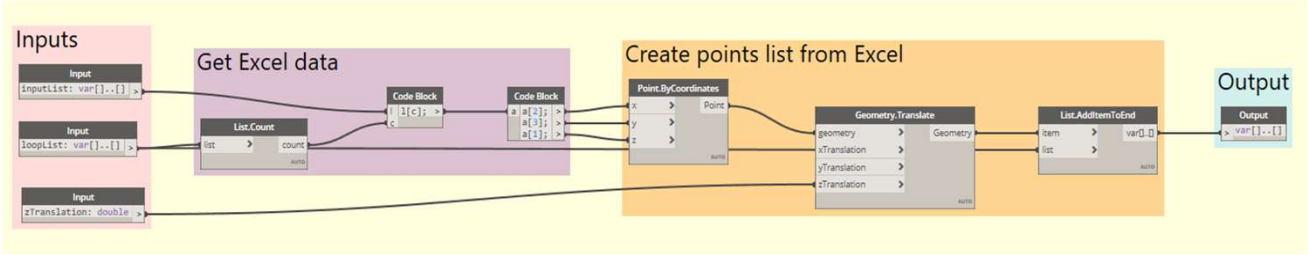
Graphic scripts

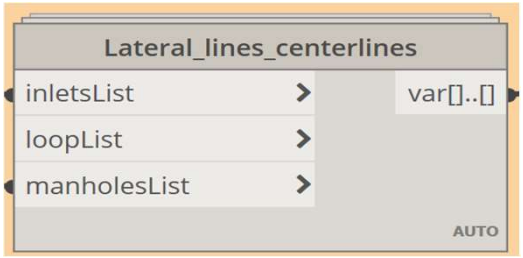


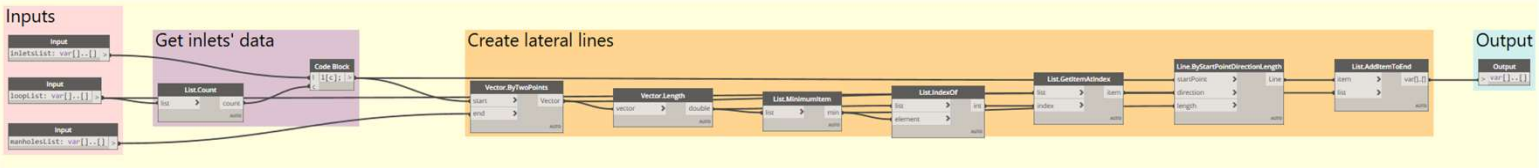
Link to the video: https://youtu.be/4ajWsQcJysY

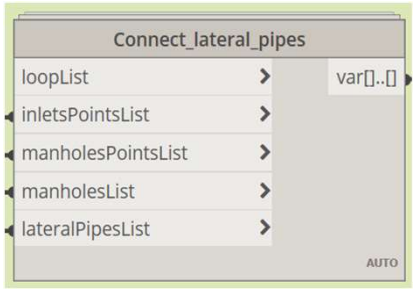
Custom nodes

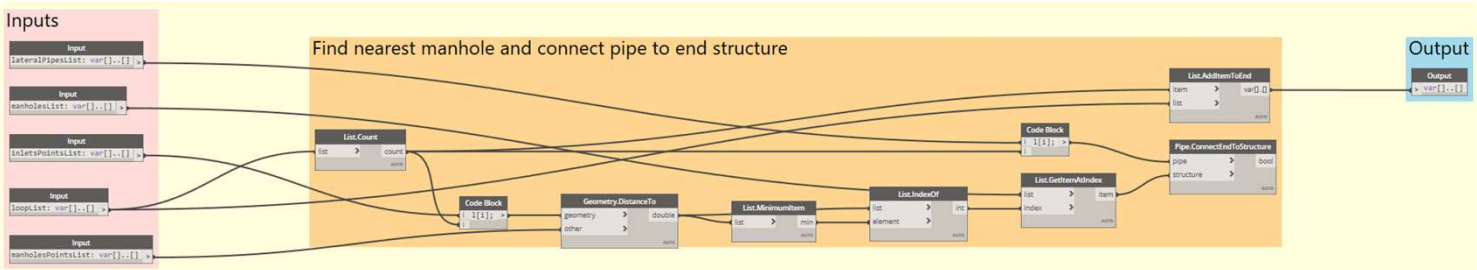








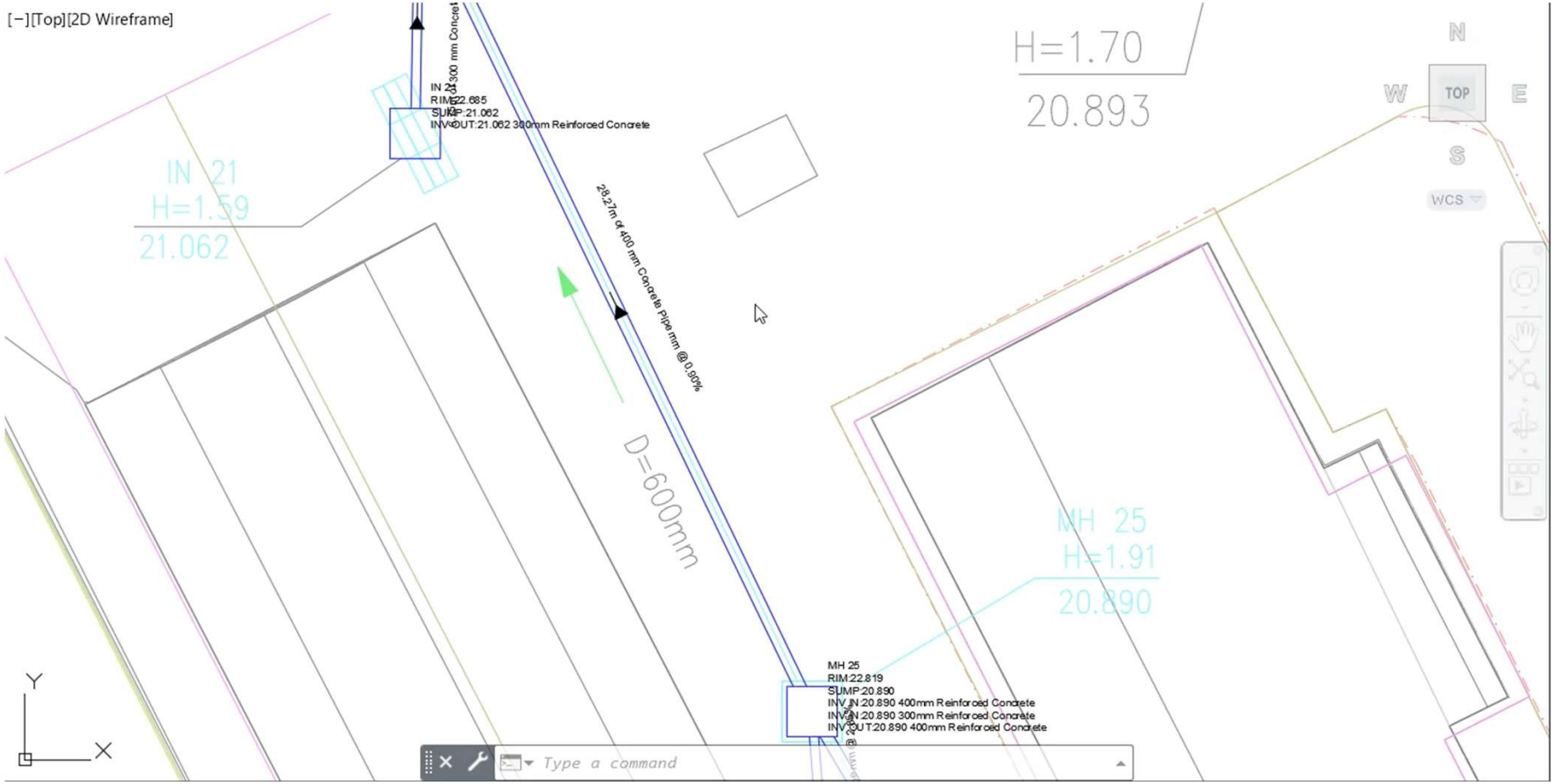




Pipe networks design in high density underground infrastructure environment

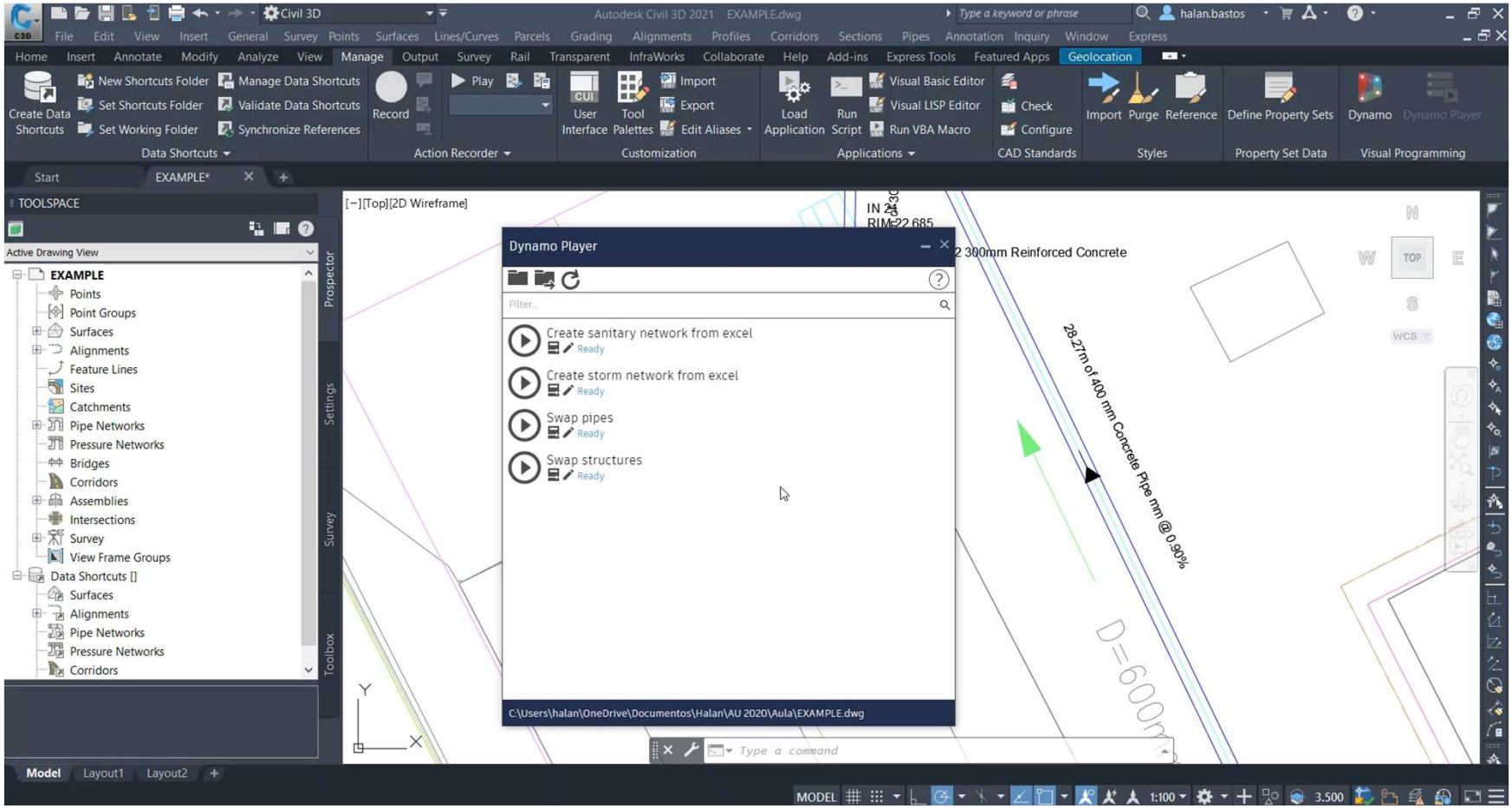
#1	#2	#3	#4
MODELING	SWAPPING	INTERFERENCES	SOLVING
Model a drainage system in a high density urban underground environment using Civil 3D and Dynamo	Swap network parts through Dynamo	Run interference check tool in Civil 3D	Solve interferences between two networks using Civil 3D

Set networks parts list first



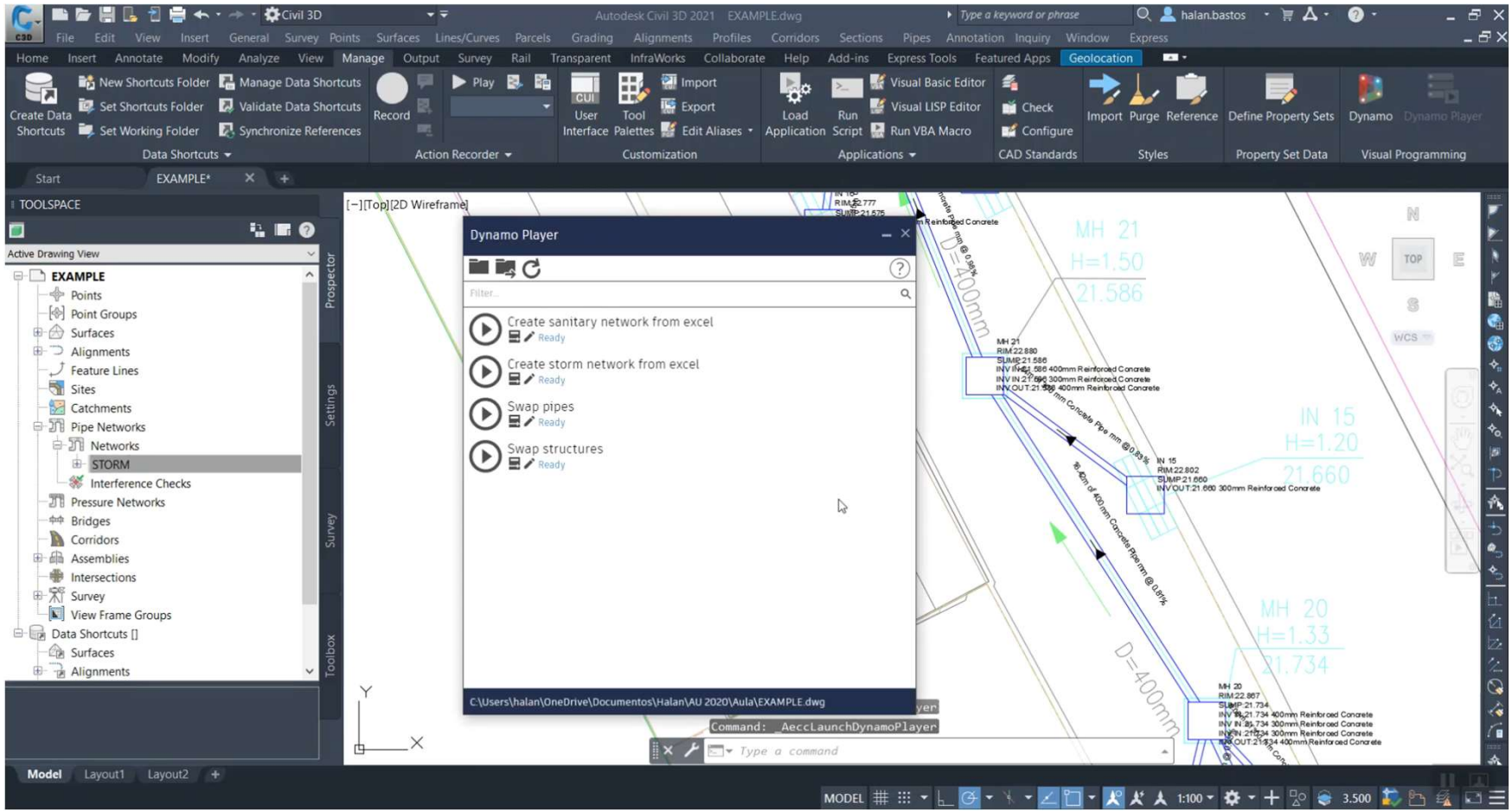
Link to the video: https://youtu.be/XZRMlmc1REM

Swap multiple pipes



Link to the video: https://youtu.be/Oa1jeXh558A

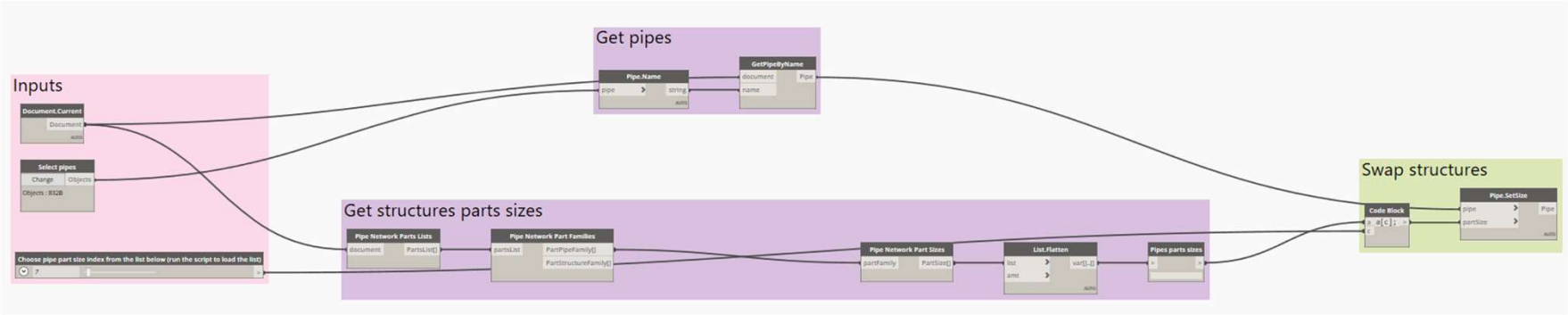
Swap multiple structures



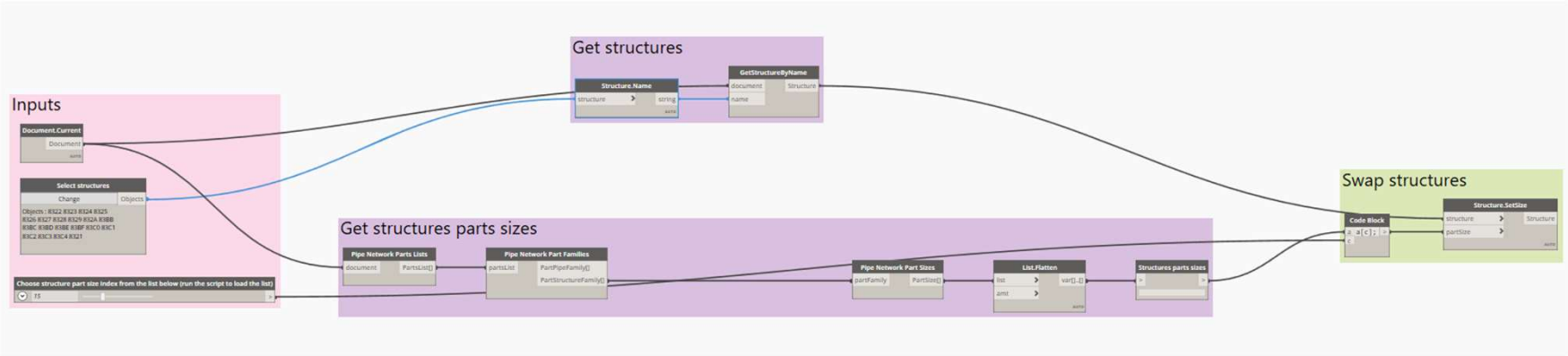
Link to the video: https://youtu.be/cJjoBMXxUH0

Graphic scripts

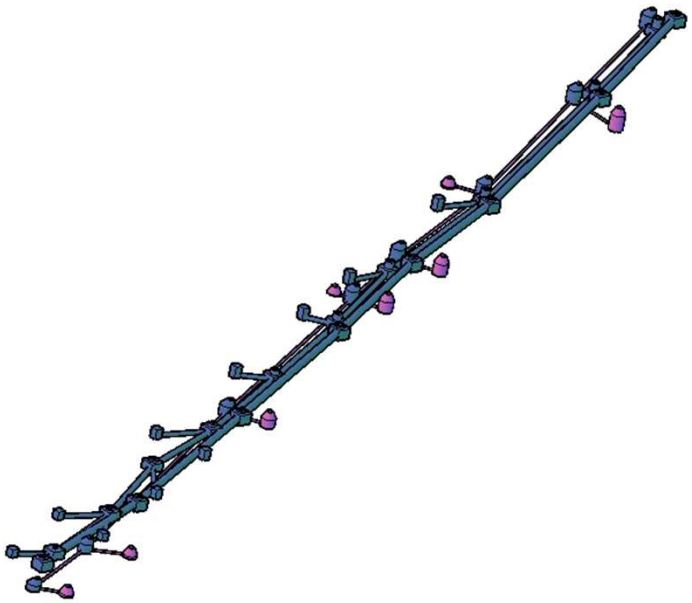
Swap multiple pipes



Swap multiple structures



Complete urban underground 3D model



Link to the video: https://youtu.be/K9rJLlVcIz0

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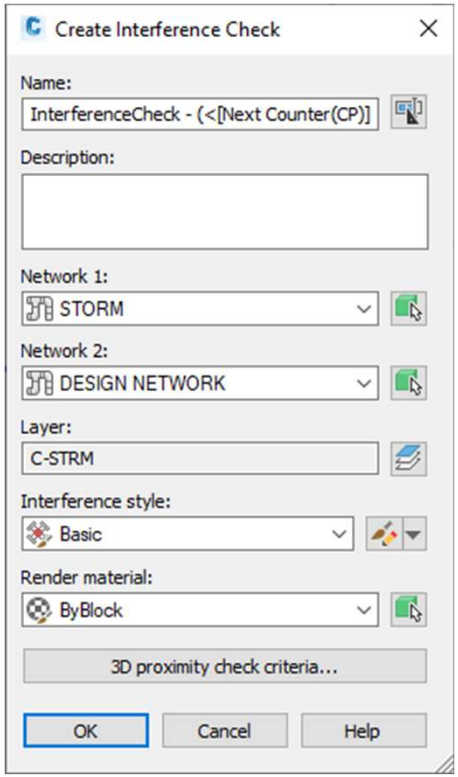
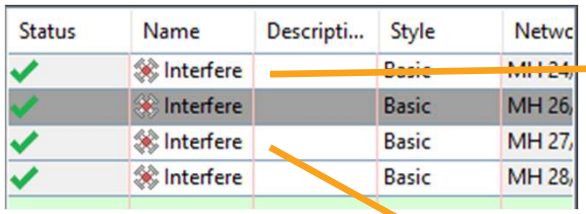
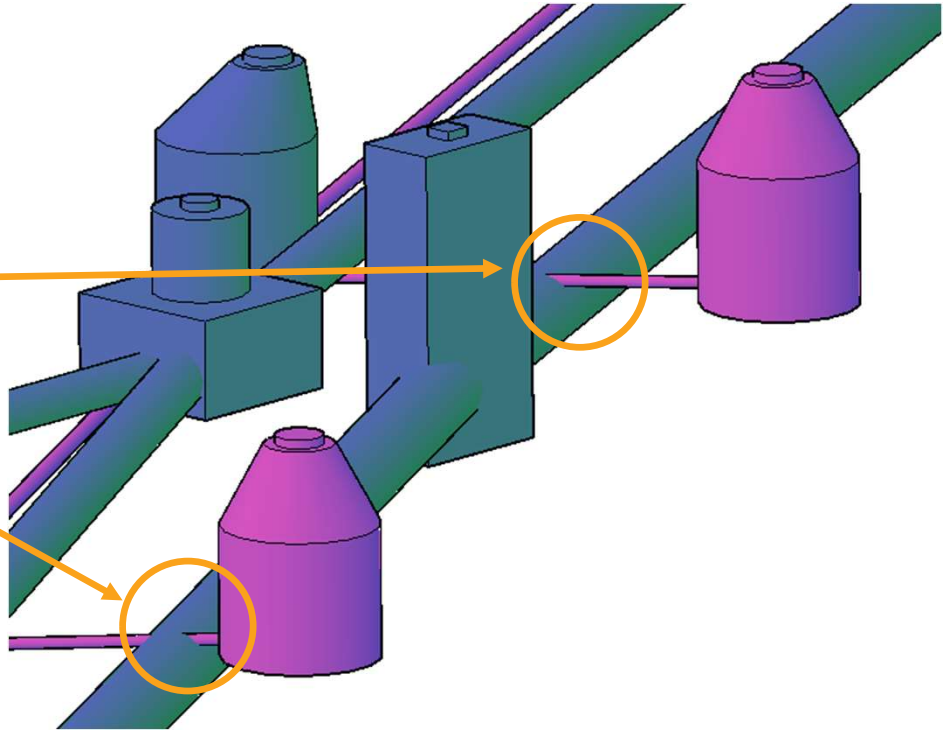
Interference check







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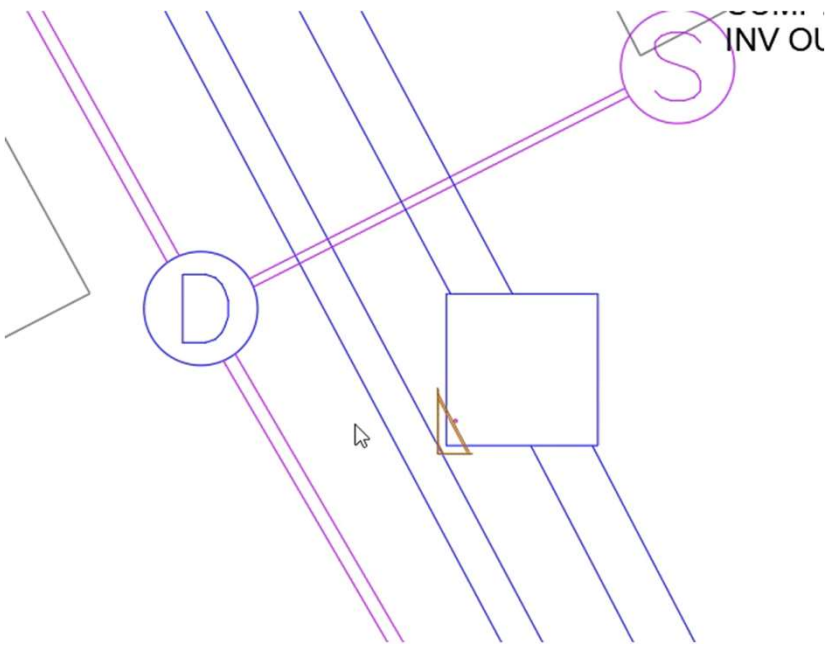
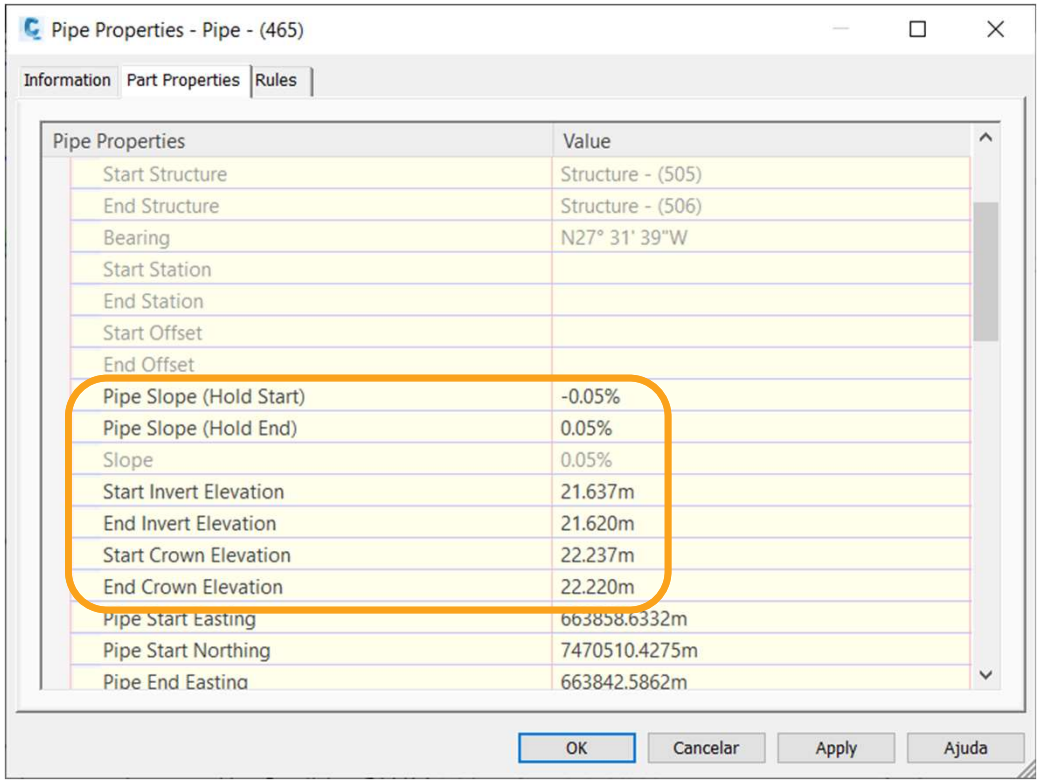
Solved interferences

Structure position (horizontal interference)



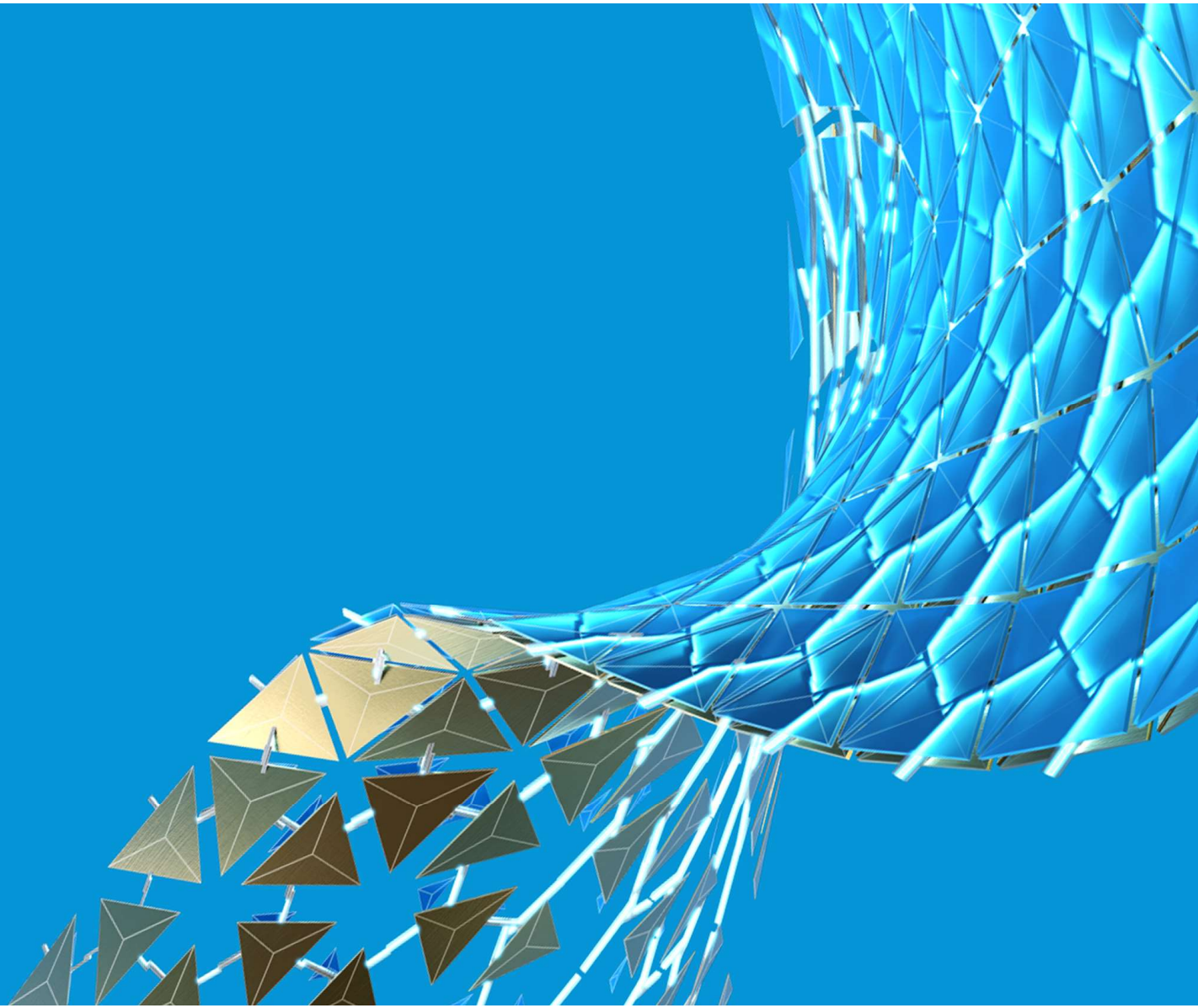
Pipe properties (vertical interference)



Pipe Properties	Value
Start Structure	Structure - (505)
End Structure	Structure - (506)
Bearing	N27° 31' 39"W
Start Station	
End Station	
Start Offset	
End Offset	
Pipe Slope (Hold Start)	-0.05%
Pipe Slope (Hold End)	0.05%
Slope	0.05%
Start Invert Elevation	21.637m
End Invert Elevation	21.620m
Start Crown Elevation	22.237m
End Crown Elevation	22.220m
Pipe Start Easting	663858.6332m
Pipe Start Northing	7470510.4275m
Pipe End Easting	663842.5862m

Link to the video: https://youtu.be/Nd_i_mZJTbw

Conclusion



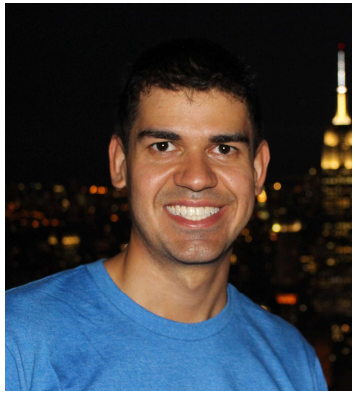
Conclusion

- Dynamo allows users to automate repetitive tasks in Civil 3D
- The creation of simple graphic scripts can help designers to swap multiple parts at once
- Dynamo improves the productivity of any design team
- Existing underground infrastructures can be modeled using BIM

Please help me by recommending my class.

Recommend (17)

If you have any questions or suggestions, please leave it on the comments section in my class page.



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