Case Study: Digital Twin for the New Union Turnpike Bridge

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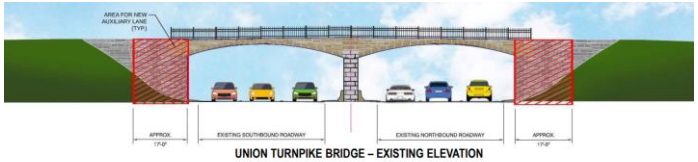
Contents

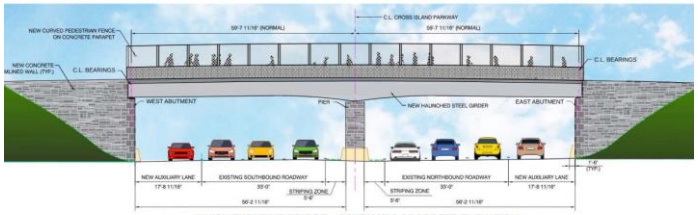
1. Case Study
2. Project Description
3. Site Visit
4. Methodology
5. Schedule
6. Project Progress
7. Conclusions and Strategies

1. Case Study: Union Turnpike Bridge

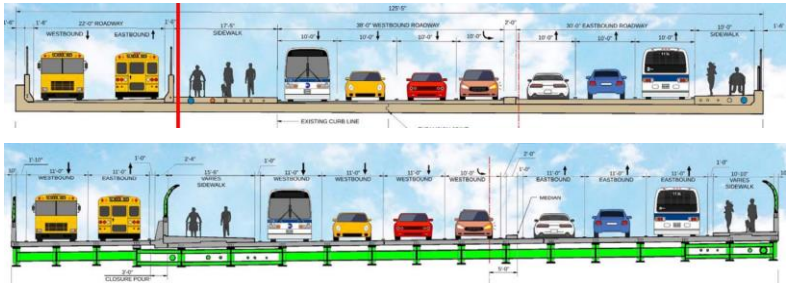
- **Location:** Intersection of Union Turnpike and Cross Island Parkway.
- **Scope of the work:** The existing bridge will be removed and replaced in its entirety with a new bridge



UNION TURNPIKE BRIDGE – EXISTING ELEVATION

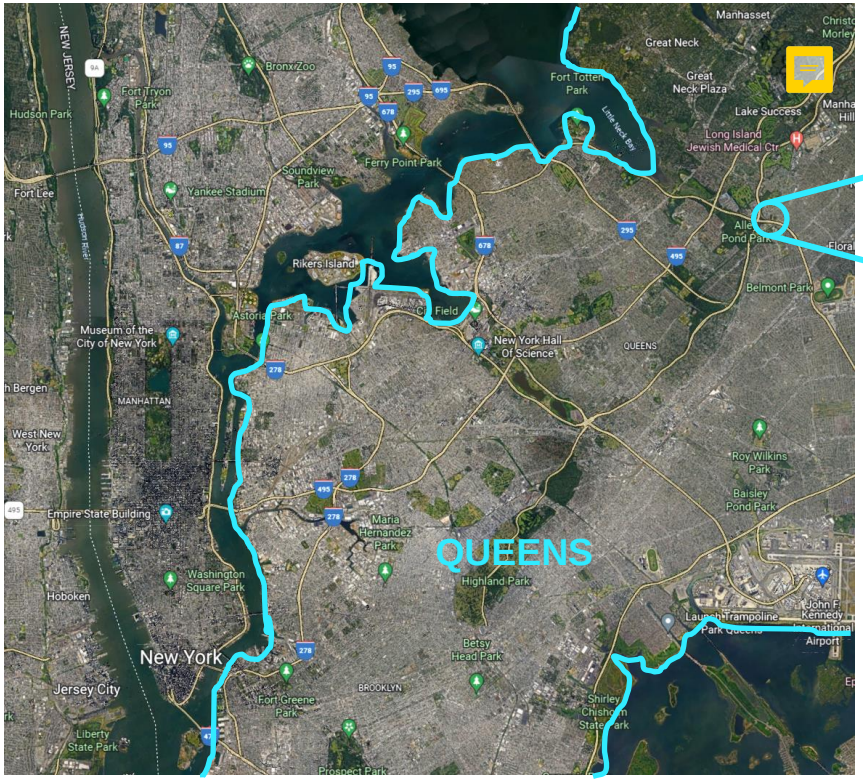


UNION TURNPIKE BRIDGE – SCHEMATIC PROPOSED ELEVATION



Existing and Proposed Bridge (DOT, 2022)

1. Case Study: Location and Surroundings

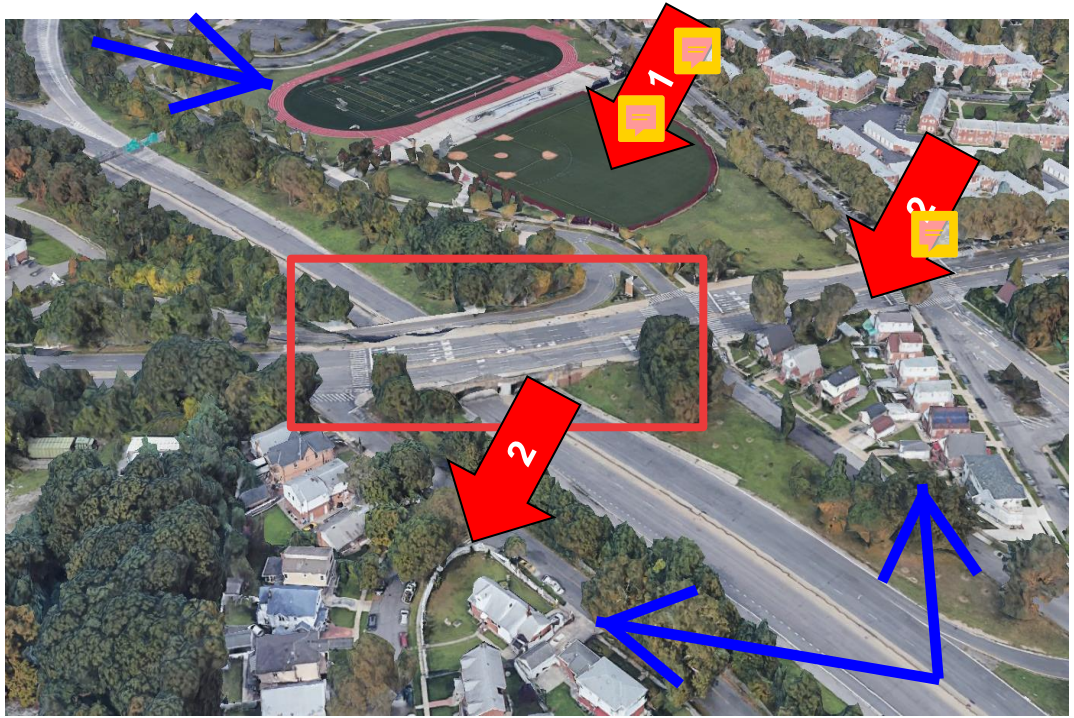


Location: Intersection Union Turnpike & Cross Island Parkway

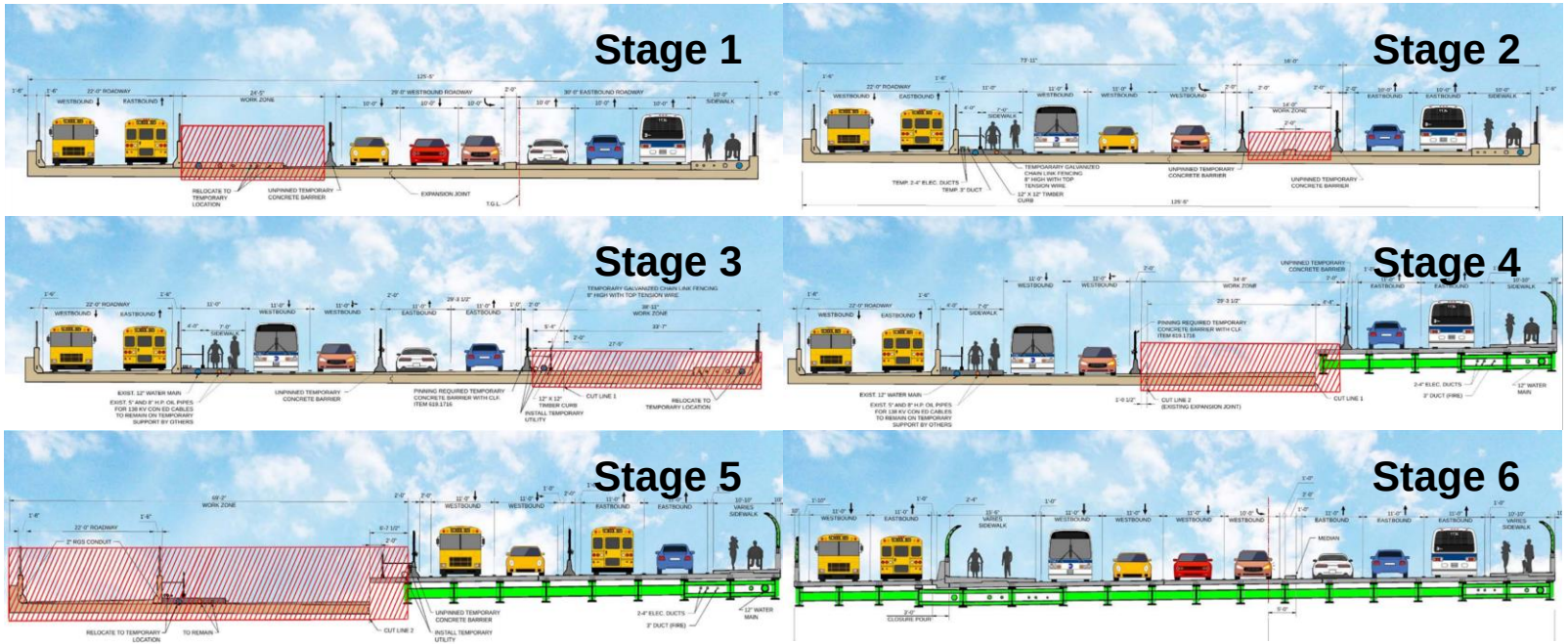
1. Case Study: Location and Surroundings

Surrounding Facilities and Houses:

- Queens High School of Teaching (1)
- Residential Areas (2)

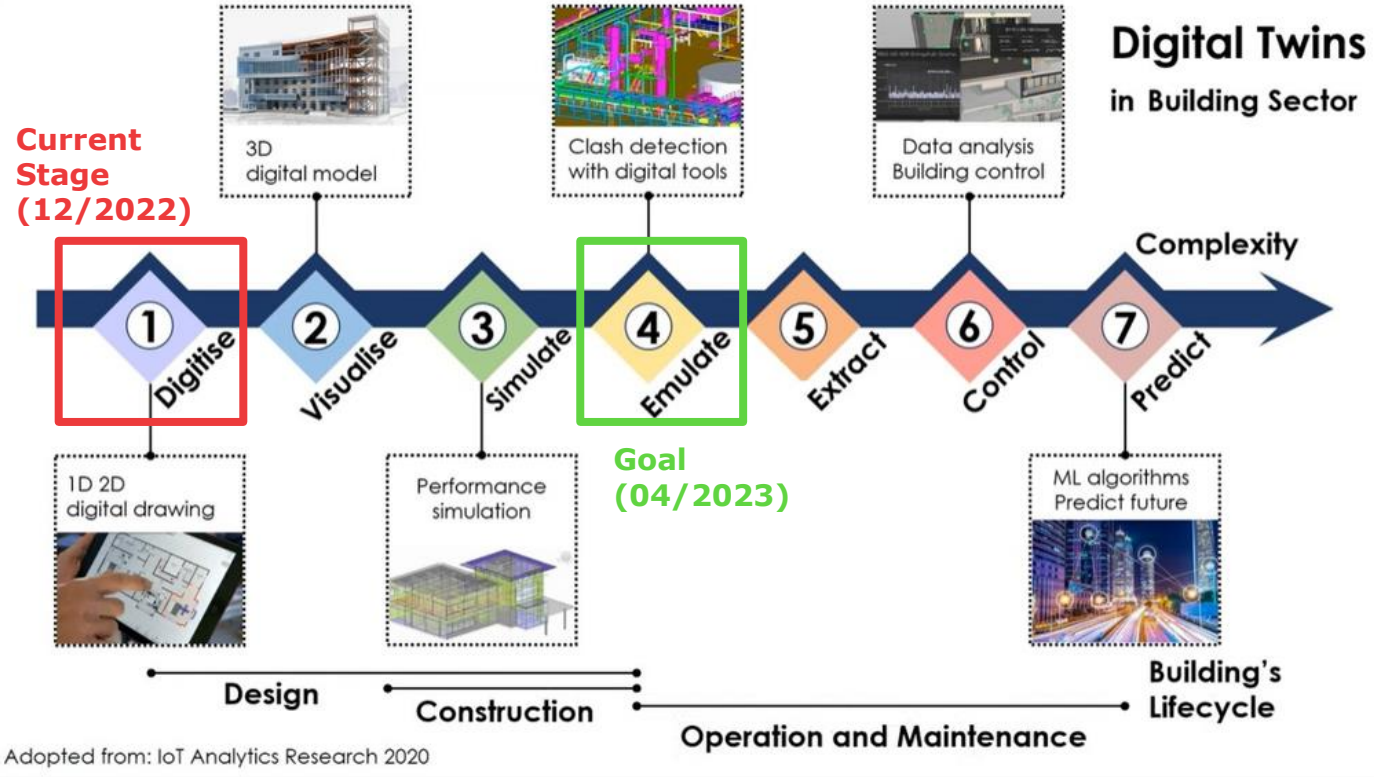


2. Case Study: Construction Phases (3)



Existing and Proposed Bridge (DOT, 2022)

2. Project Description

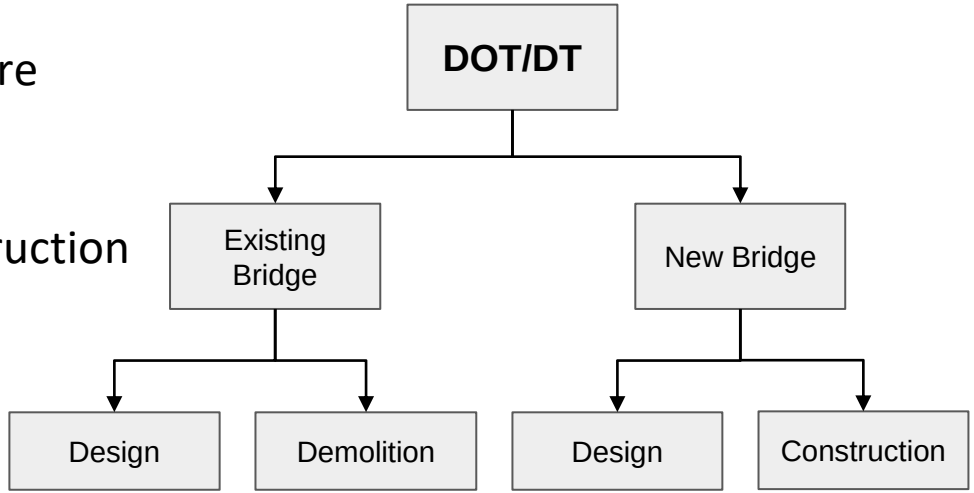


2. Project Description

SCOPE OF WORK

- 3D Modeling of the existing Structure
- 3D Modeling of the new Structure
- 4D Integration and phases of construction

Deadline: April 2023

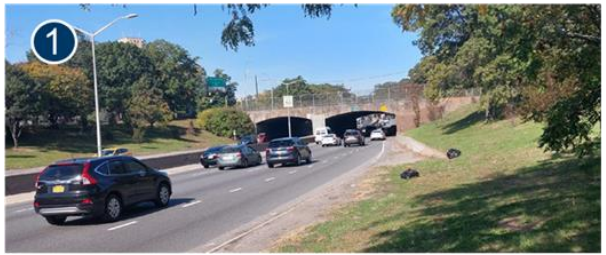


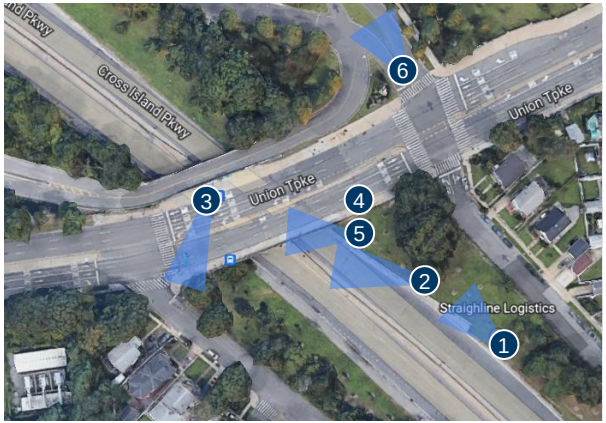
3. Site Visit

A. Site Visit 10/12/2022: Pictures

B. Identification of critical zones

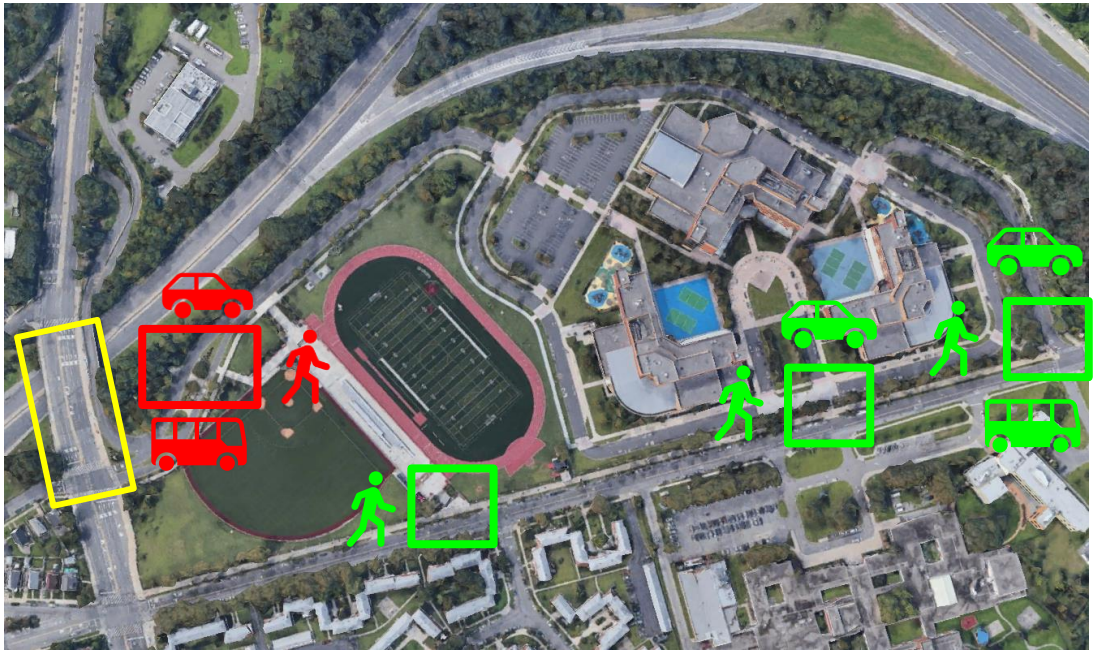
A. Site Visit: Pictures





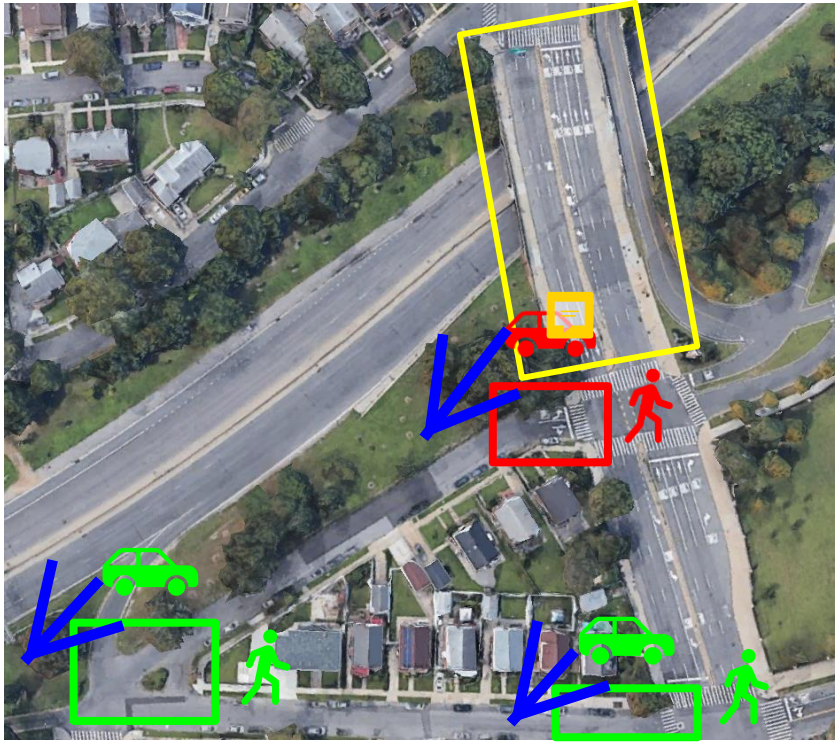
B. Site Visit: Identification of Critical Zones

1. **Queens High School of Teaching:**
    a. 959 students
    b. Three vehicular access
    c. Four pedestrian access



B. Site Visit: Identification of Critical Zones

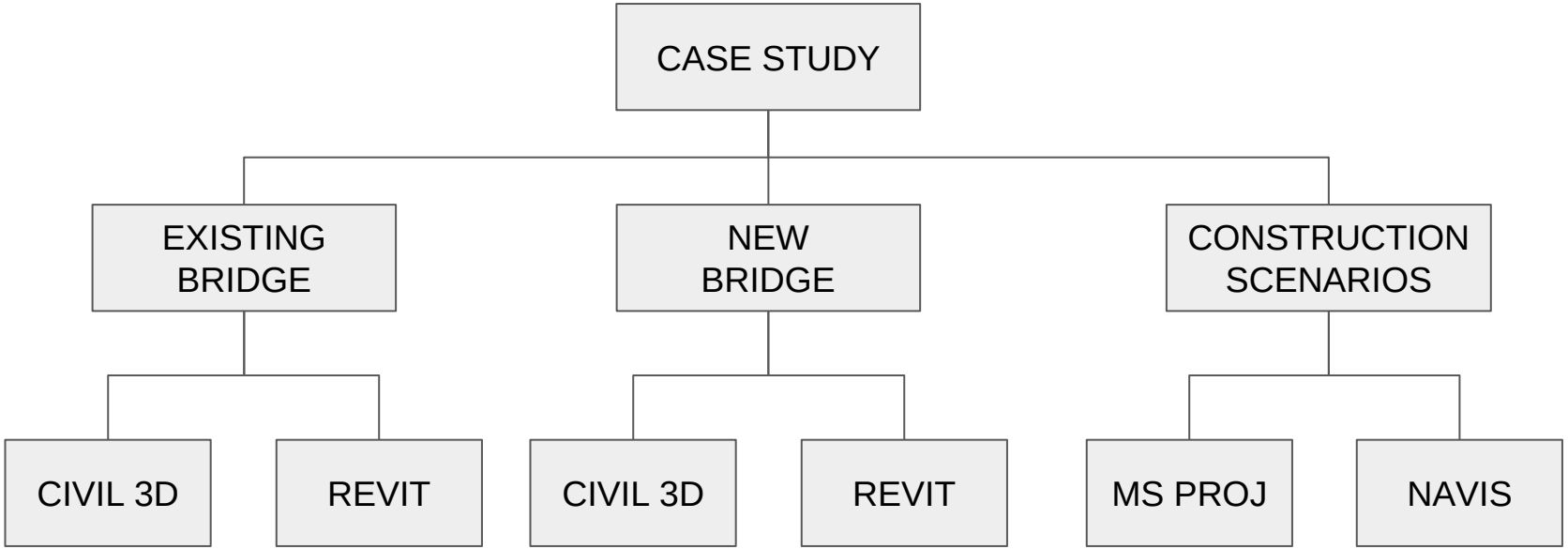
1. **Residential area 1:**
    a. 10 houses
    b. ≈ 50 people (1 family per house, 5 people per family
    c. 3 vehicular and pedestrian access



B. Site Visit: Identification of Critical Zones

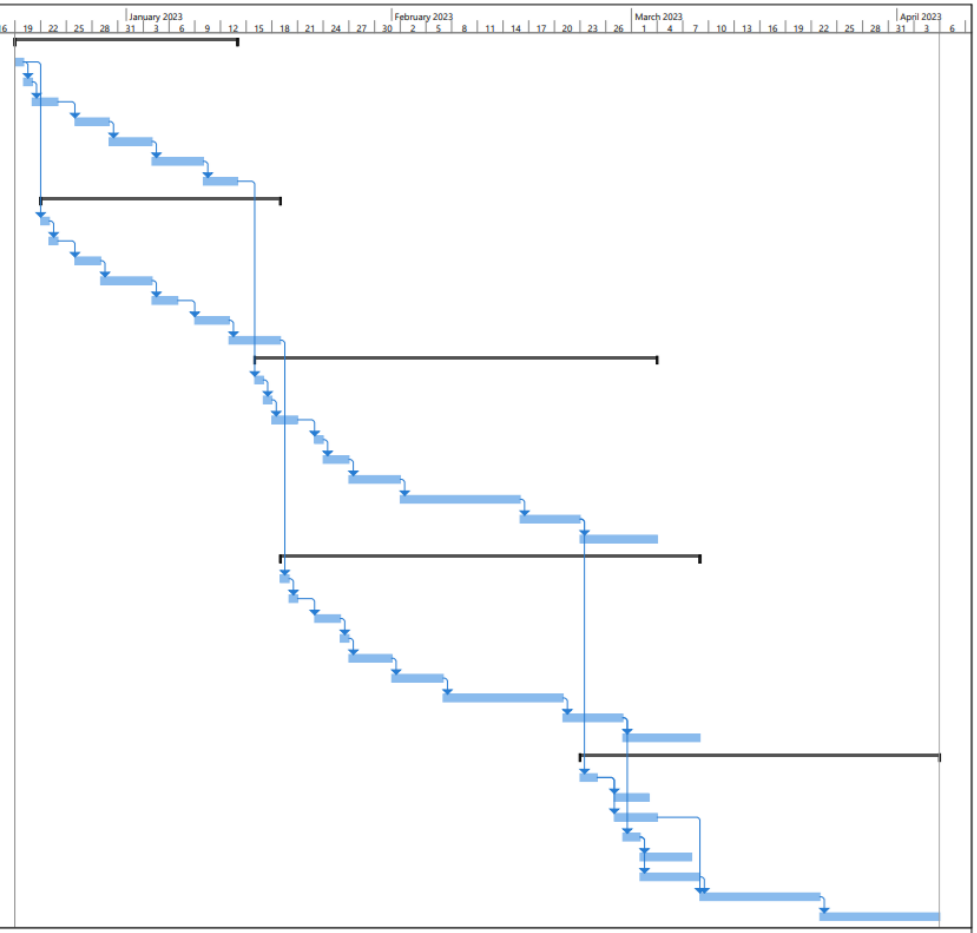
1. **Residential area 2:**
    a. +20 houses
    b. ≈ +100 people (1 family per house, 5 people per family
    c. 2 vehicular and pedestrian access

4. Plan Proposal (1): WBS



5. Schedule (1): Base Timeline

ID	Task Mode	Task Name	Duration	Start	Finish
1		**Civil 3D - Existing Bridge**	**20 days**	Mon 12/19/22	**Fri 1/13/23**
2		Import the points	1 day	Mon 12/19/22	Mon 12/19/22
3		Create the surface	1 day	Tue 12/20/22	Tue 12/20/22
4		Correct the Data	3 days	Wed 12/21/22	Fri 12/23/22
5		Create the Alignment	4 days	Mon 12/26/22	Thu 12/29/22
6		Create the Profile	3 days	Fri 12/30/22	Tue 1/3/23
7		Create the Section	4 days	Wed 1/4/23	Mon 1/9/23
8		Generate the Corridor	4 days	Tue 1/10/23	Fri 1/13/23
9		**Civil 3D - New Bridge**	**20 days**	**Thu 12/22/22**	**Wed 1/18/23**
10		Import the points	1 day	Thu 12/22/22	Thu 12/22/22
11		Create the surface	1 day	Fri 12/23/22	Fri 12/23/22
12		Correct the Data	3 days	Mon 12/26/22	Wed 12/28/22
13		Create the Alignment	4 days	Thu 12/29/22	Tue 1/3/23
14		Create the Profile	3 days	Wed 1/4/23	Fri 1/6/23
15		Create the Section	4 days	Mon 1/9/23	Thu 1/12/23
16		Generate the Corridor	4 days	Fri 1/13/23	Wed 1/18/23
17		**Revit - Existing Bridge**	**35 days**	**Mon 1/16/23**	**Fri 3/3/23**
18		Create a Generic Family for DWG	1 day	Mon 1/16/23	Mon 1/16/23
19		Import the DWG file into Revit	1 day	Tue 1/17/23	Tue 1/17/23
20		Create Families	3 days	Wed 1/18/23	Fri 1/20/23
21		Create Parameters	1 day	Mon 1/23/23	Mon 1/23/23
22		Assign Families to the DWG	3 days	Tue 1/24/23	Thu 1/26/23
23		Split Elements	4 days	Fri 1/27/23	Wed 2/1/23
24		Create the Pipes	10 days	Thu 2/2/23	Wed 2/15/23
25		Create the Fences and other Arch. Elements	5 days	Thu 2/16/23	Wed 2/22/23
26		Material Quantification	7 days	Thu 2/23/23	Fri 3/3/23
27		**Revit - New Bridge**	**35 days**	**Thu 1/19/23**	**Wed 3/8/23**
28		Create a Generic Family for DWG	1 day	Thu 1/19/23	Thu 1/19/23
29		Import the DWG file into Revit	1 day	Fri 1/20/23	Fri 1/20/23
30		Create Families	3 days	Mon 1/23/23	Wed 1/25/23
31		Create Parameters	1 day	Thu 1/26/23	Thu 1/26/23
32		Assign Families to the DWG	3 days	Fri 1/27/23	Tue 1/31/23
33		Split Elements	4 days	Wed 2/1/23	Mon 2/6/23
34		Create the Pipes	10 days	Tue 2/7/23	Mon 2/20/23
35		Create the Fences and other Arch. Elements	5 days	Tue 2/21/23	Mon 2/27/23
36		Material Quantification	7 days	Tue 2/28/23	Wed 3/8/23
37		**Navisworks - Existing and New**	**30 days**	**Thu 2/23/23**	**Wed 4/5/23**
38		Link Models of Existing	2 days	Thu 2/23/23	Fri 2/24/23
39		Clash Detection Existing	4 days	Mon 2/27/23	Thu 3/2/23
40		Assign Timeline to the Existing	5 days	Mon 2/27/23	Fri 3/3/23
41		Link Models of New	2 days	Tue 2/28/23	Wed 3/1/23
42		Clash Detection New	4 days	Thu 3/2/23	Tue 3/7/23
43		Assign Timeline to the New	5 days	Thu 3/2/23	Wed 3/8/23
44		Create Simulations and Iterations	10 days	Thu 3/9/23	Wed 3/22/23
45		Generate Final Report	10 days	Thu 3/23/23	Wed 4/5/23



Project: CBIPS new schedule
Date: Tue 11/29/22

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

5. Schedule (1): Base Timeline

DECEMBER 19th, 2022

JANUARY 13th, 2023

JANUARY 18th, 2023

MARCH 3th, 2023

MARCH 8th, 2023

APRIL 4th, 2023

APRIL 4th, 2023

Note:
Duration and Sequence Forecasted considering 2 people in the group

ID	Task Mode	Task Name	Duration	Start	Finish
			20 days	**Mon 12/19/22**	**Fri 1/13/23**
			1 day	Mon 12/19/22	Mon 12/19/22
			1 day	Tue 12/20/22	Tue 12/20/22
			3 days	Wed 12/21/22	Fri 12/23/22
5		Create the Alignment	4 days	Mon 12/26/22	Thu 12/29/22
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			3 days	Wed 1/4/23	Fri 1/6/23
15		Create the Section	4 days	Mon 1/9/23	Thu 1/12/23
16		Generate the Corridor	4 days	Fri 1/13/23	Wed 1/18/23
17		**Revit - Existing Bridge**	**35 days**	**Mon 1/16/23**	**Fri 3/3/23**
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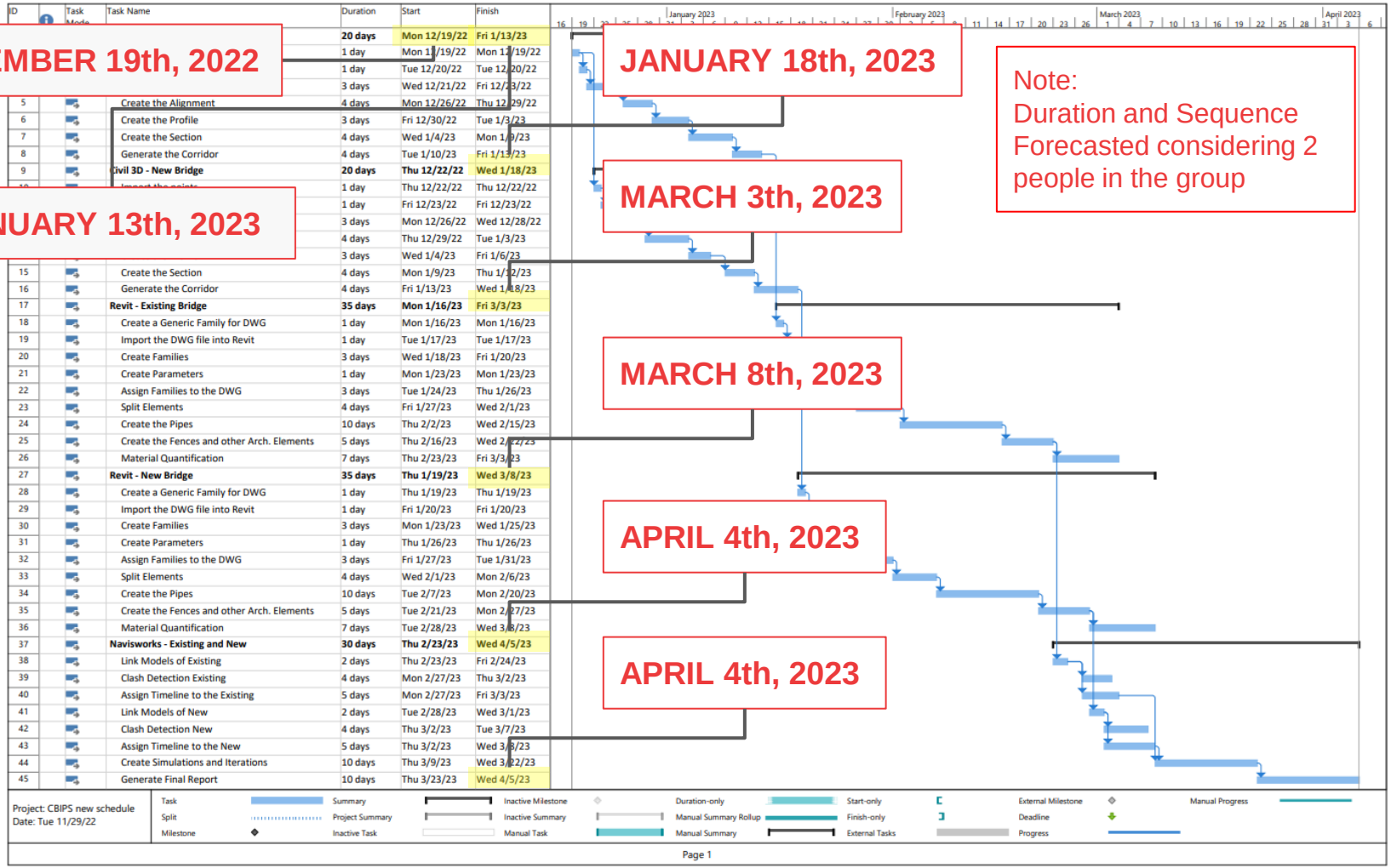
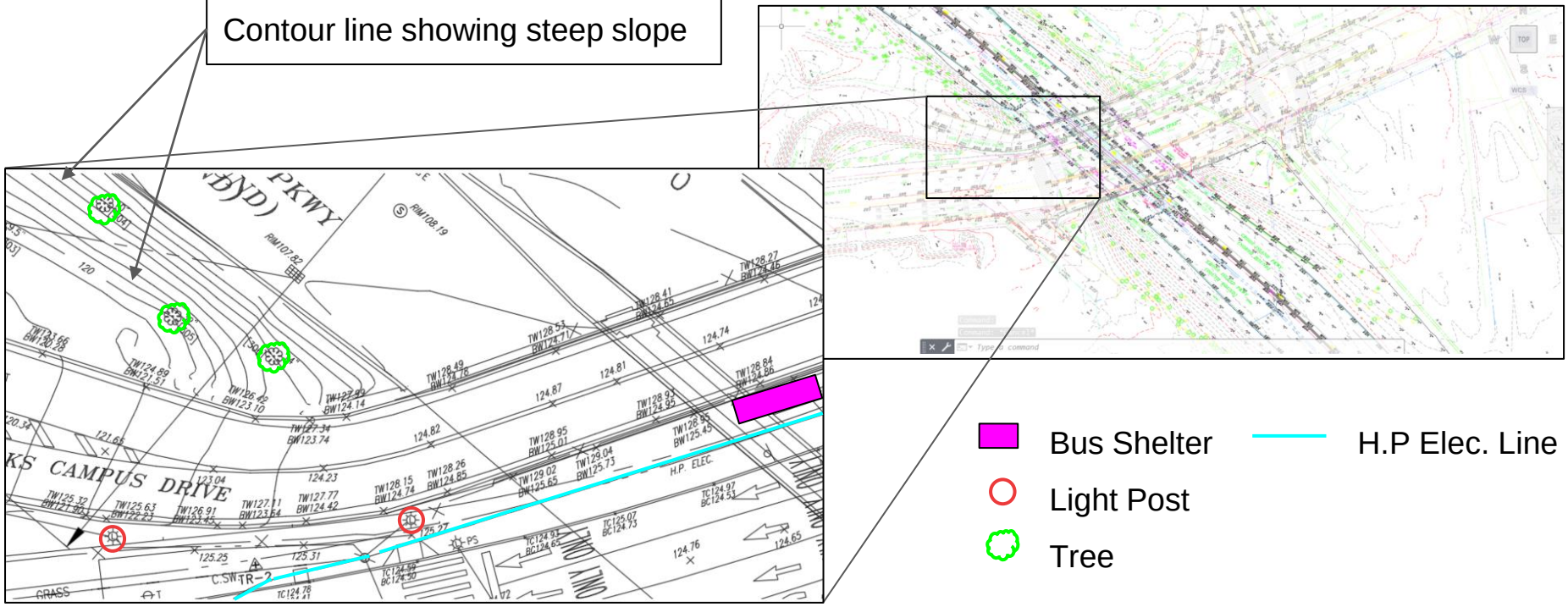


5. Schedule (2): Milestones

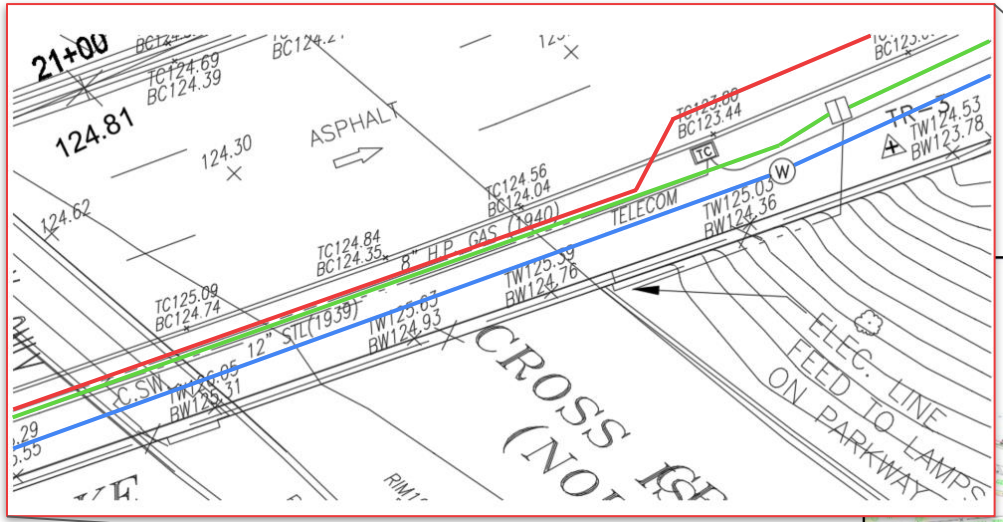
1.	Existing Bridge CIVIL 3D	**01/13/2023**
2.	New Bridge CIVIL 3D	**01/18/2023**
3.	Existing Bridge REVIT	**03/03/2023**
4.	New Bridge REVIT	**03/08/2023**
5.	Scenarios NAVISWORKS	**04/04/2023**

6. Project Progress: Topographic Map

Contour line showing steep slope



6. Project Progress: Topographic Map



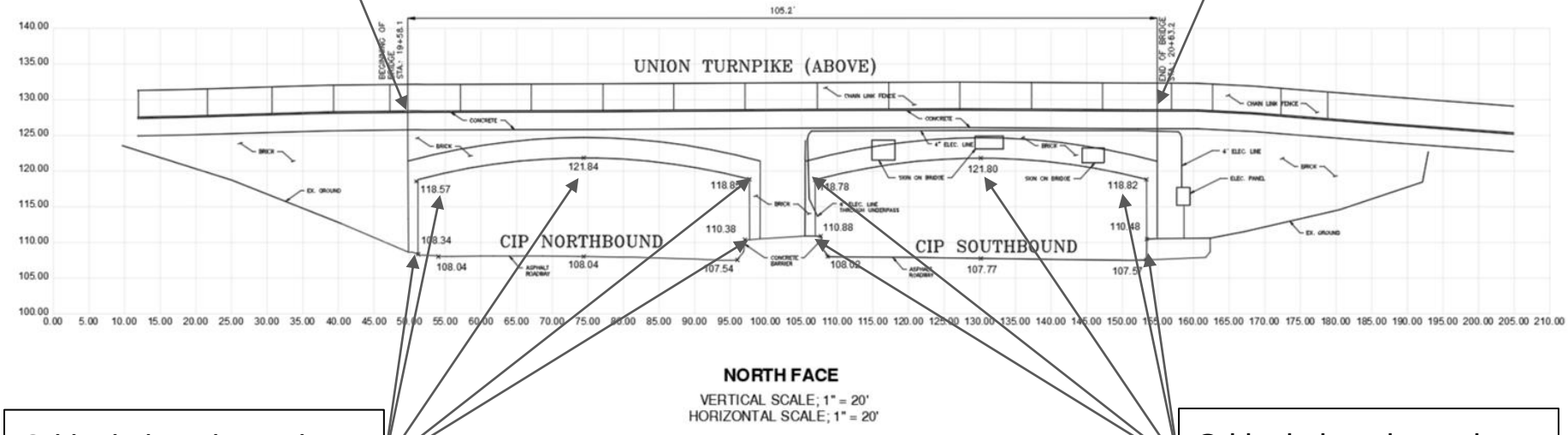
Gas Line
Telecom Line
Water Line

Cross Island Parkway

6. Project Progress: Section of UTP Bridge

Beginning of Bridge

End of Bridge



NORTH FACE

VERTICAL SCALE; 1" = 20'
HORIZONTAL SCALE; 1" = 20'

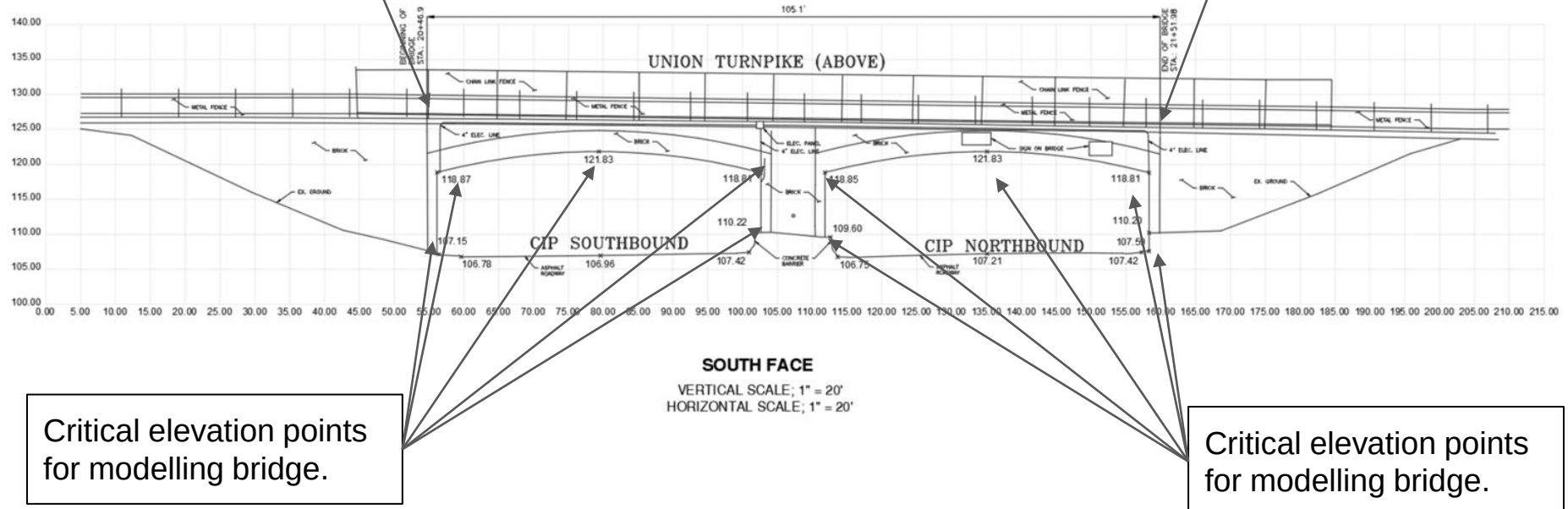
Critical elevation points for modelling bridge.

Critical elevation points for modelling bridge.

6. Project Progress: Section of UTP Bridge

Beginning of Bridge

End of Bridge

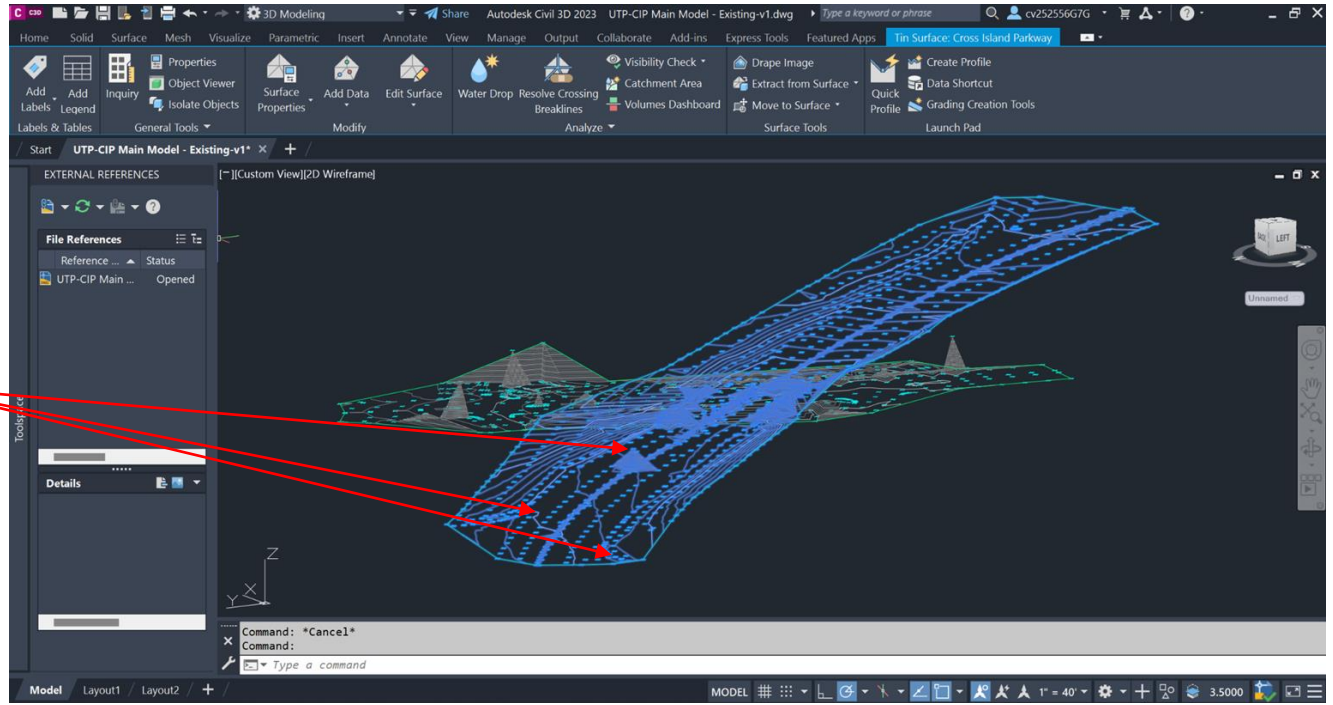


Critical elevation points for modelling bridge.

Critical elevation points for modelling bridge.

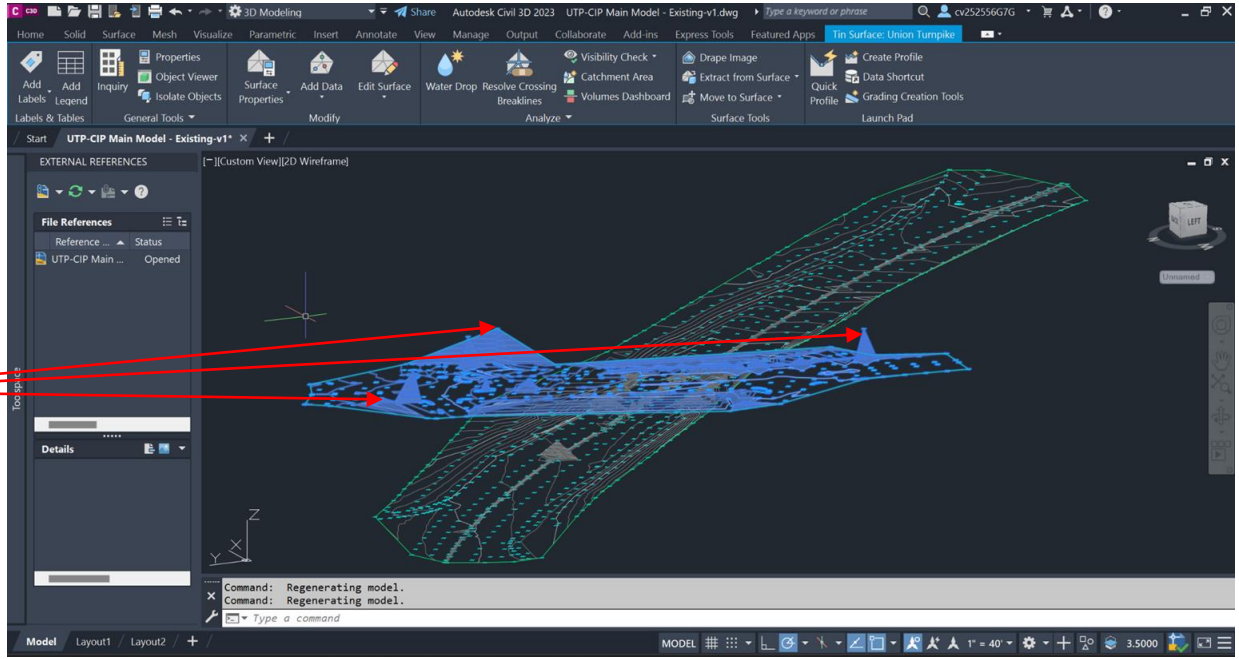
6. Project Progress: Data Points

Ironing of elevation points is required



6. Project Progress: Data Points

Ironing of elevation points is required



7. Conclusions and Strategies

- Work divided in 3 sections: CIVIL 3D, REVIT, NAVISWORKS
- Time adjusted to complete the project before the deadline **APRIL,2023**
- Forecast considering two students in the group

Next Semester and Winter Break

<u>Request to work from the DOT:</u>

- 3 days per week during the winter break
- 1 or 2 days per week during the spring semester (Rotation)
- Presentations next semester will include information about devices that will help to develop the digital twin of the new bridge

8. References

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Appendix

COLUMBIA | CBIPS

Center for Buildings, Infrastructure and Public Space

DOT 3D/BIM RESEARCH PROJECT

CBIPS 2022-2023

CBIPS MEMBERS

BIM Guidelines

- Sai Mithil Krishna Kumar
- Feng Zhang
- Qixiao Zhang

Case Study

- Waheed Ahmad
- Julio Tupayachi
- Atmaja Vilas Patil
- Rishav Shrivastav
- Chintan Vohra

Contents

- **SPONSOR**
- **PART 1:** BIM GUIDELINES
- **PART 2:** CASE OF STUDY - UNION TURNPIKE

SPONSOR

- New York City Department of Transportation (NYCDOT)
- The New York City Department of Transportation (NYCDOT) is the **agency of the government of New York City** responsible for the management of much of New York City's transportation infrastructure.

PART 1: BIM GUIDELINES FOR BRIDGES

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Contents

- General Introduction
- Objectives
- Schedule and timeline

Objectives of the Guidelines for use of BIM in bridges

- The current practices in other departments and how they transitioned
- Applications of BIM for DoT in terms of reducing the cost, reducing delays and change orders
- Usage of digital twins in the old bridges on east river
- Help with coordination between various departments such as the structural and architectural, etc
- Compatibility
- The lifespan of this software

Schedule and Timeline

SEP 2022
Literature Review & current practices

Nov 2022
Steps to make a BIM model for existing bridge

Dec 2022
Interim Presentation

Jan Feb 2023
Steps to create BIM Model for new Bridge

April 2023
Final Presentation

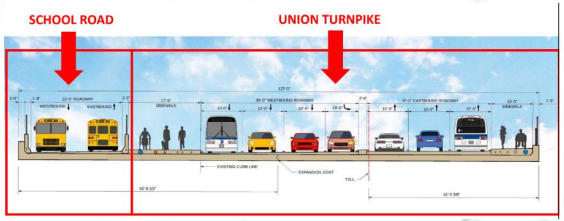
PART 2: Replacement of Union Turnpike Bridge over Cross Island Parkway

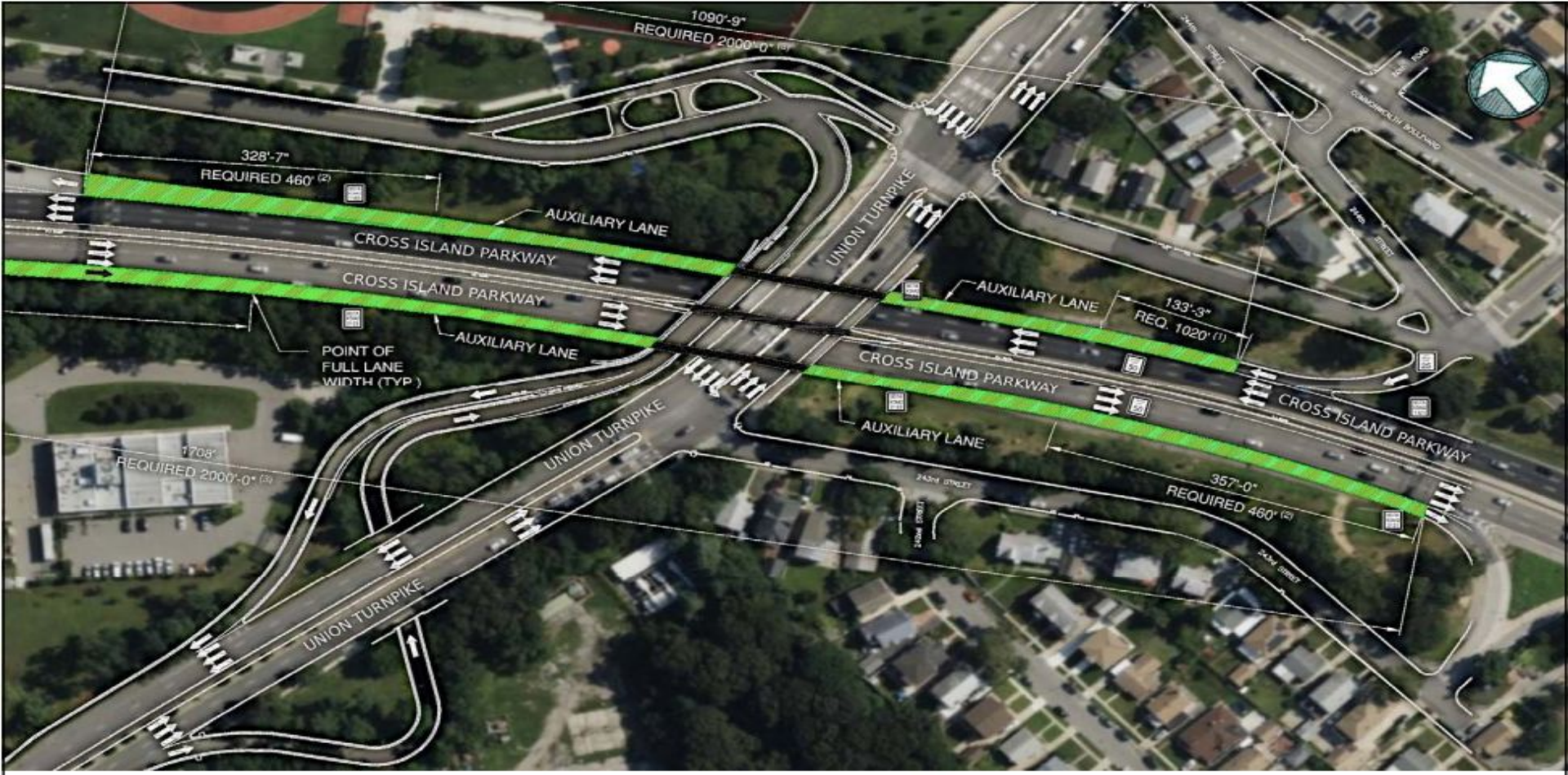
Contents

- General Introduction
- Objective
- Identified Tasks
- Schedule and timeline

General Information

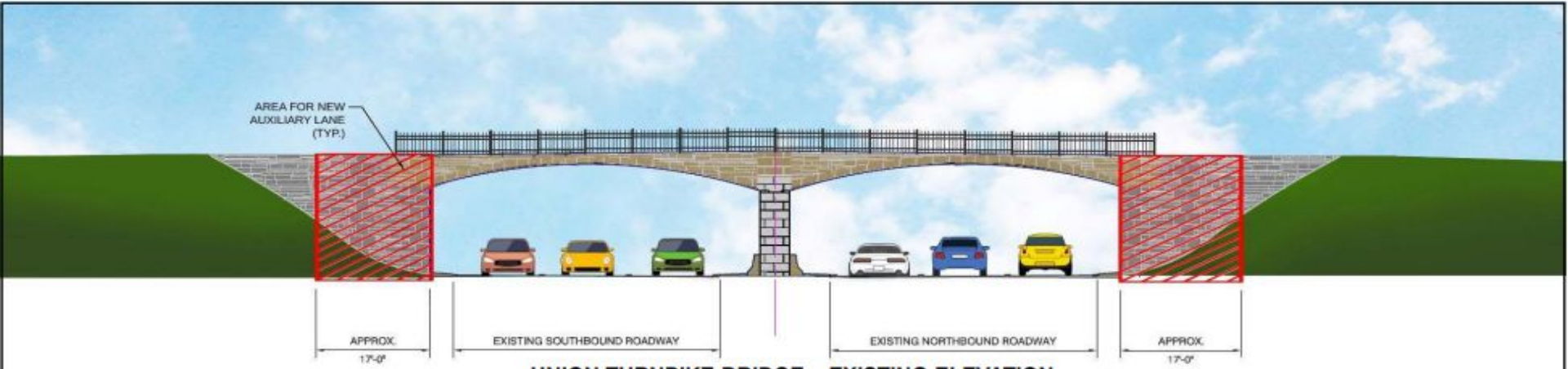
- Double decked arch bridge, 1953
- Connects Manhattan and Queens
- Largest span length 65.90 feet
- Three (3) eastbound through lanes, four (4) westbound lanes, two (2) school access lanes
- 2 Pedestrian sidewalks



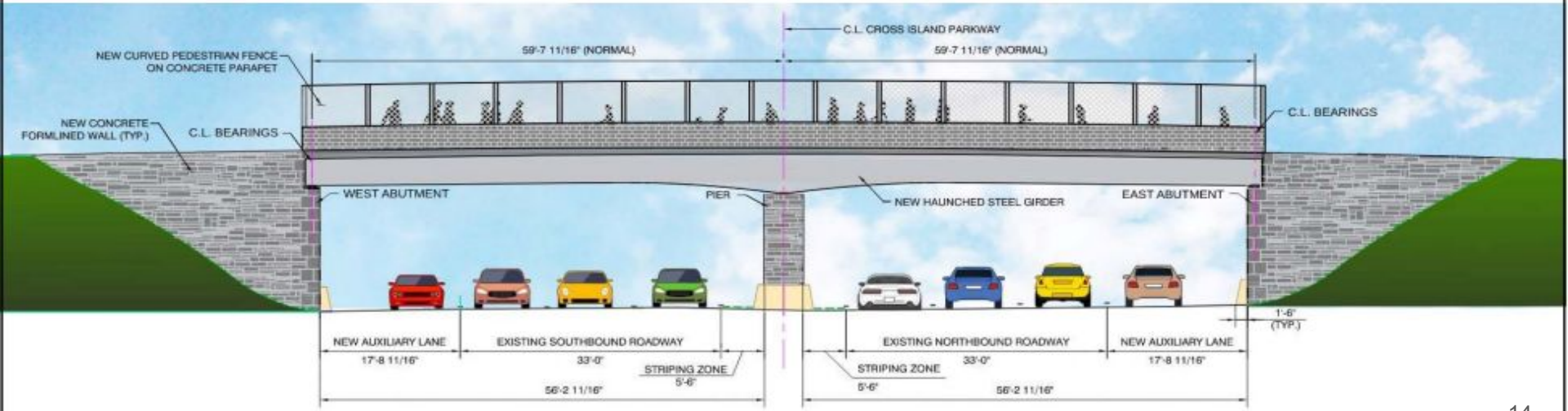


Proposed Bridge

Schematic Plan View



UNION TURNPIKE BRIDGE – EXISTING ELEVATION



UNION TURNPIKE BRIDGE – SCHEMATIC PROPOSED ELEVATION

Objective

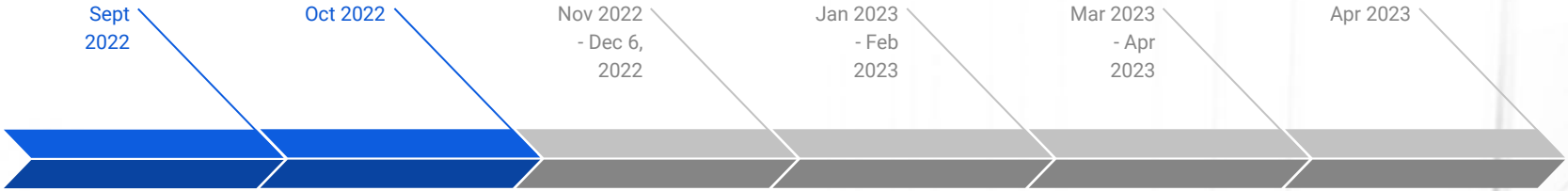
- **General Objective:** To evaluate the use of BIM for better visualization, higher accuracy, better cost estimates, identifying conflicts, constructability reviews, reduction in costly change orders and less delays.

- **Specific Objective:** Use BIM to model the existing and the proposed bridge configuration and hence visually identify the challenges the utilities pose to the construction process

Identified Tasks:

1) Collect existing data and literature review.
2) Create a BIM model of the existing bridge and utilities.
3) Create a BIM model of the proposed bridge.
4) Prepare a BIM model showing the sequence of construction and identify the conflicts posed in construction.
5) Use the BIM model to calculate the estimate of quantities and develop construction drawings.
6) Evaluate the pros and cons of the BIM model in comparison to the conventional 2D-drawings.

Schedule and Timeline



Data Collection & Literature review

Create BIM model of existing condition

Create BIM model of the proposed bridge & Interim Report

Prepare BIM model showing sequence of construction

Use BIM model to prepare cost estimate and 2D drawings

Evaluate the pros and cons of BIM model & Final Report

Any Question?

CASE OF STUDY: UNION TURNPIKE BRIDGE REMODELING

IN COLLABORATION WITH NYC DEPARTMENT OF TRANSPORTATION

CBIPS Studio - Mudd 706, Columbia University
October 18, 2022

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Outline

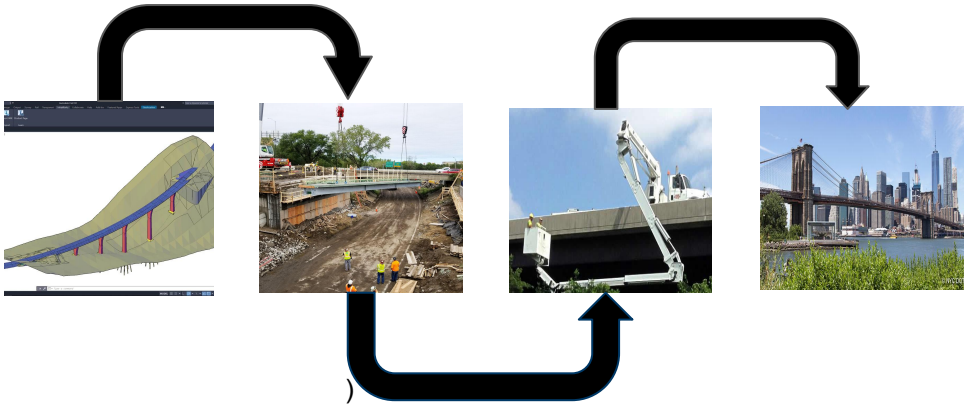
1. Literature Review
2. Description of the bridge
3. BIM Plan

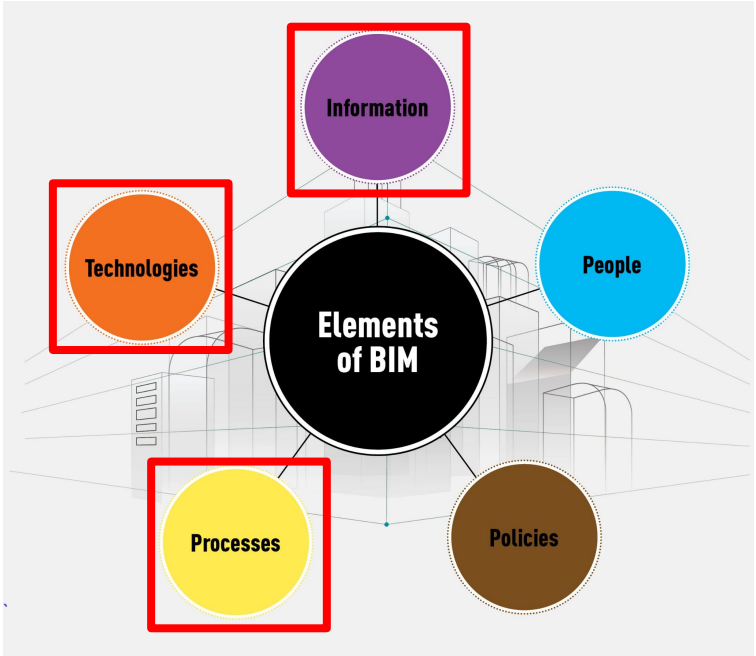
1. LITERATURE REVIEW

A. Introduction to BIM
B. Level of Detail (LOD)
C. Approach for 3D, 4D, 5D & 6D modeling
D. Available Softwares
E. Digital Twins
F. Cases of study

A. INTRODUCTION TO BIM: Definition

The process of using and developing digital representation of an object in its design, construction, maintenance, and operation

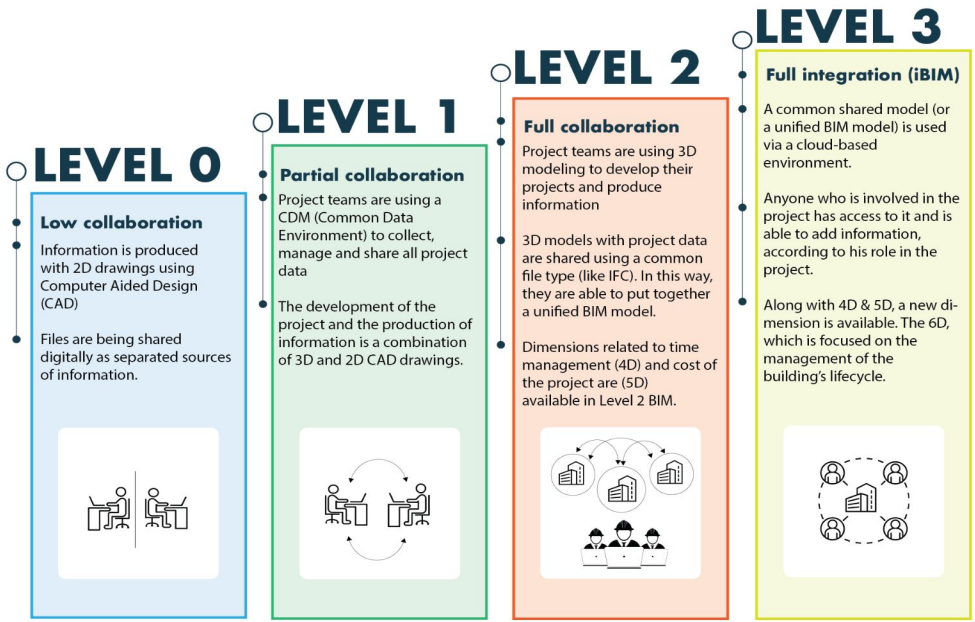




Elements of BIM (Shimonti, 2020)

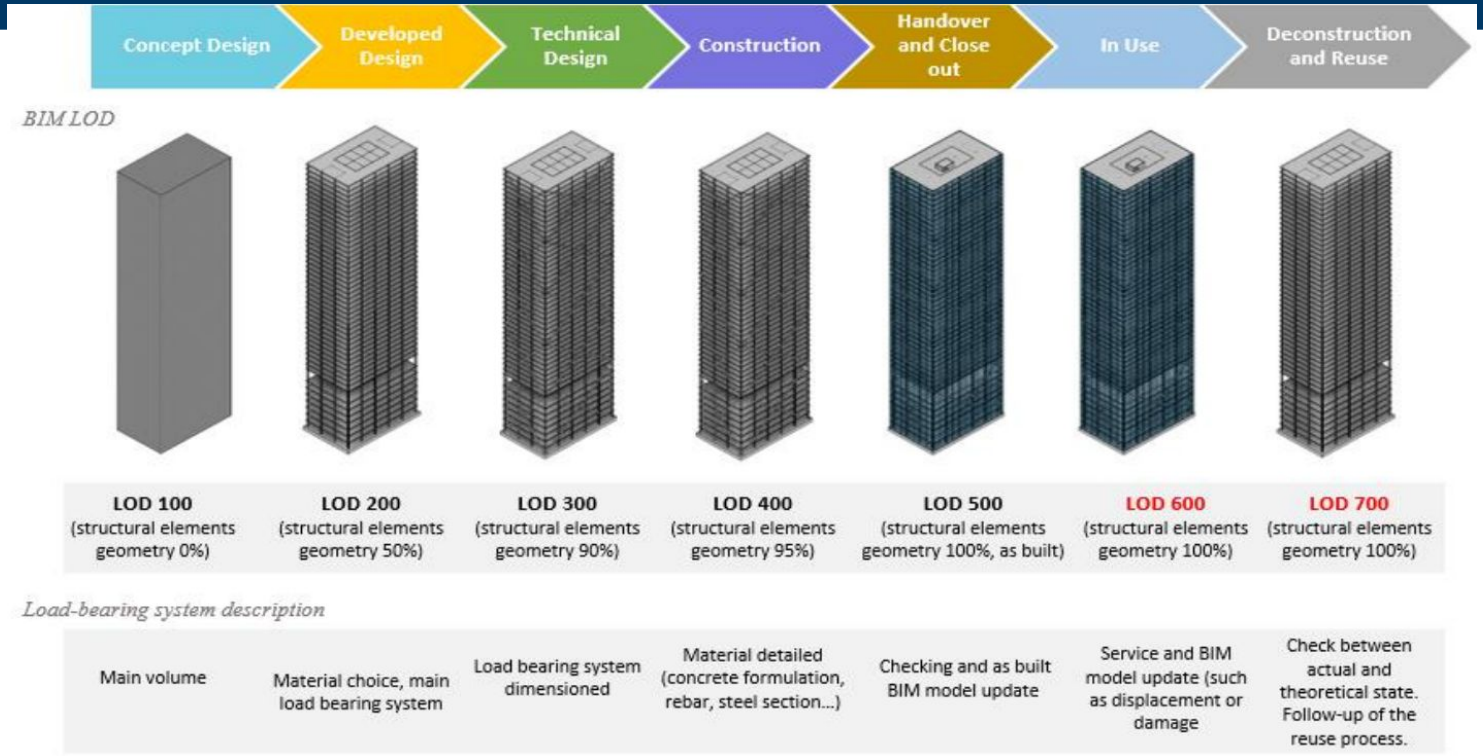
A. INTRODUCTION TO BIM: Levels of BIM

- **Level 0**: No collaboration, most of the drawings are in 2D.
- **Level 1**: Data assumed as a structure. Either 2D or 3D info.
- **Level 2**: Collaboration between group. Lack of single source of data
- **Level 3**: Collab. in planning, const., and operational life cycle. Single source of data



Levels of BIM (building the digital, 2020)

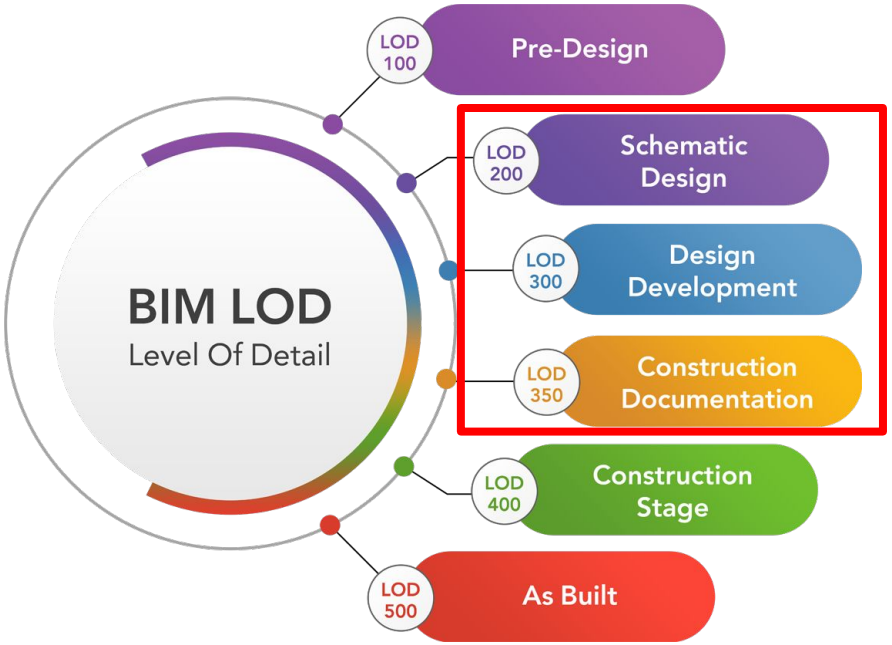
B. LEVEL OF DETAIL (LOD)



Levels of detail or development (LODs) established, and proposal for a LOD 600 and a LOD700 applied to structural elements (Bertin, Ingrid, et al.,2020)

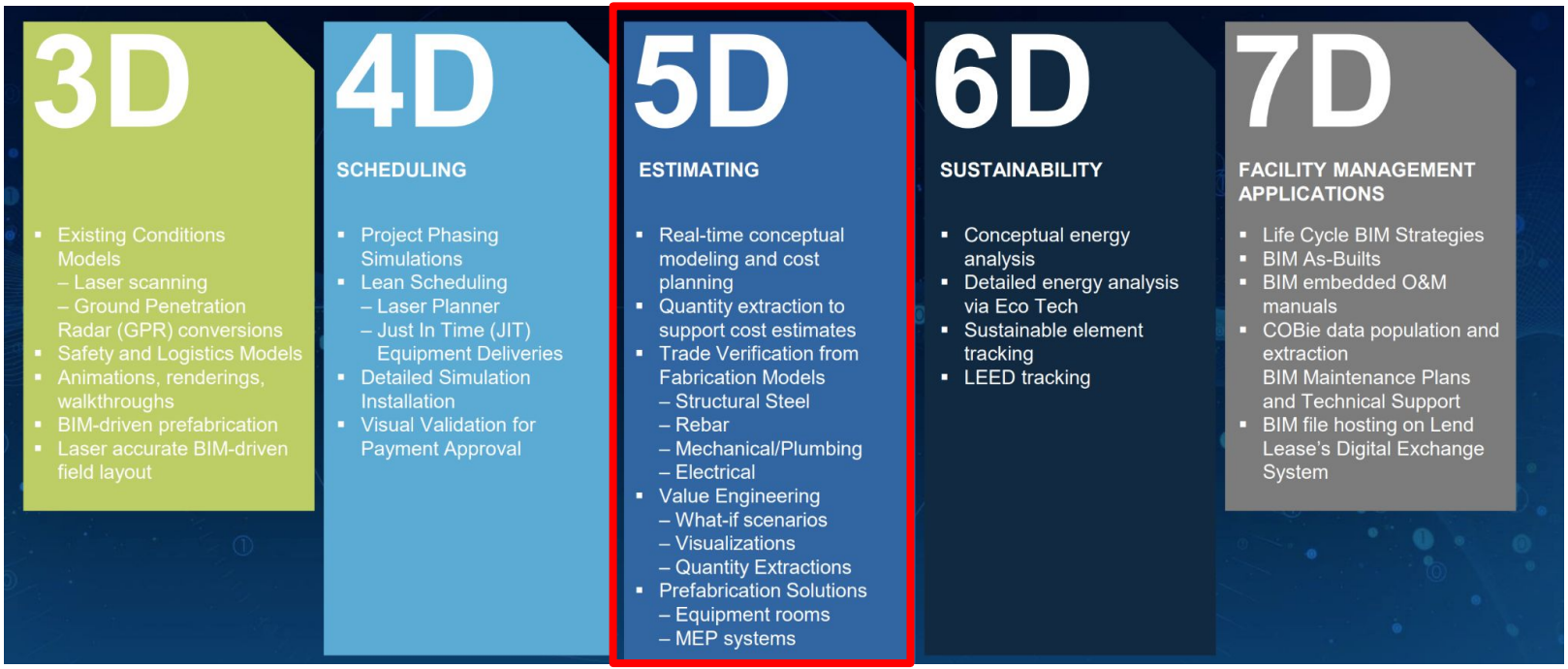
B. LEVEL OF DETAIL (LOD)

- According to the NYC BIM GUIDELINES: “Services during Construction should align with the Fifth Level of Development (LOD 500)”.
- Assigned **LOD 200** for a preliminary phase of the new and old bridges.
- Then, **LOD 300** and **LOD 350** to assign the train of activities and perform the animation of the model.



BIM LOD (BIMLEAD, ND)

C. APPROACH FOR 3D, 4D, 5D & 6D MODELLING



BIM Services (Cardoso, et al.,2021)

D. AVAILABLE SOFTWARES

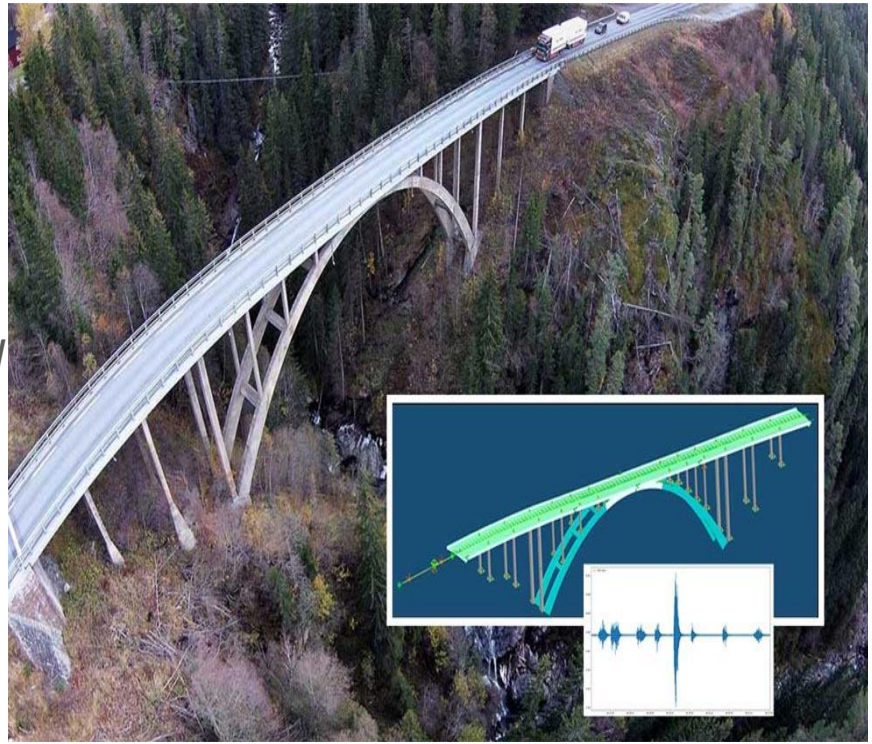
BIM Services (Cardoso, et al.,2021)

E. DIGITAL TWIN

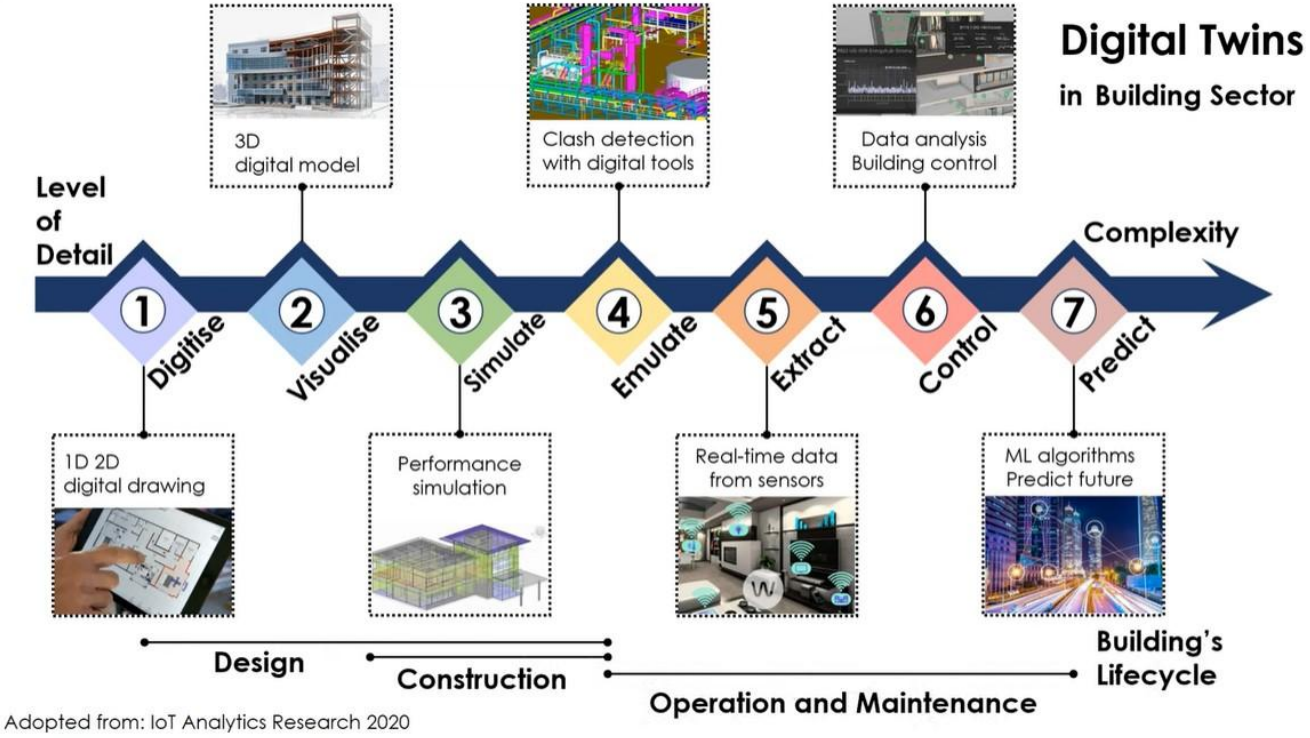
- The term “Digital Twin” was first introduced by Michael Grieves in 2002 whose application was primarily in the field of manufacturing. Over the years, the term was redefined as:

  “A digital twin serves as a virtual representation of the physical infrastructure (i.e. the physical twin), which can be updated in near real time as new data is collected, provide feedback into the physical twin and perform ‘what-if’ scenarios for assessing asset risks and predicting asset performance.”

(Ye, Cong & Butler et. al) (2019)

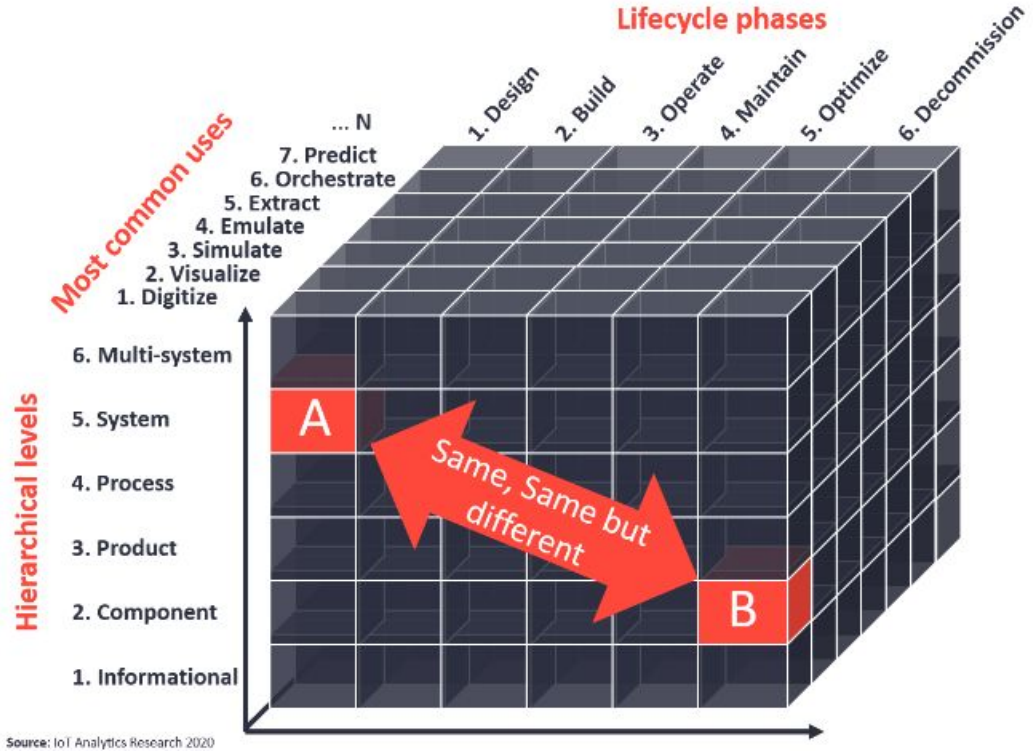


E. DIGITAL TWIN



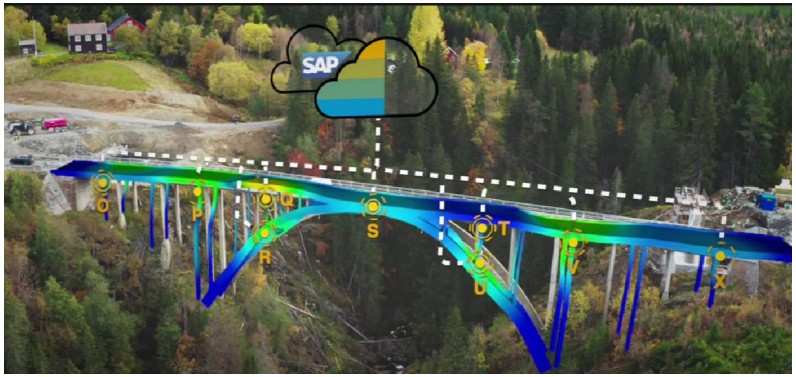
Digital Twin in Construction (2022)

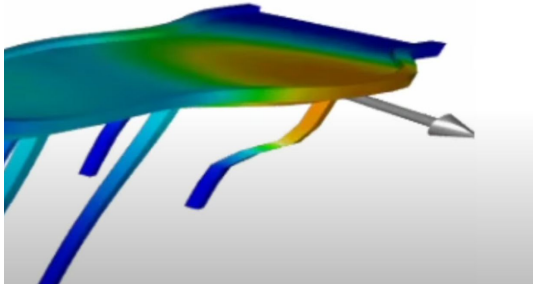
E. DIGITAL TWIN



F. DT APPLICATION: SAP Cloud Monitoring

- The Norwegian Public Road Administration (NPRA) piloted installation of Digital Twin technology to monitor bridge performance in real time.
- NPRA has deployed SAP Based IOT Connectivity, which monitors the global behavior of the bridge and uploads the sensor data to the cloud.
- If bridge dynamics then deviates from the set thresholds the system issues an alert, which can allow the administration to divert traffic and initiate necessary repair.



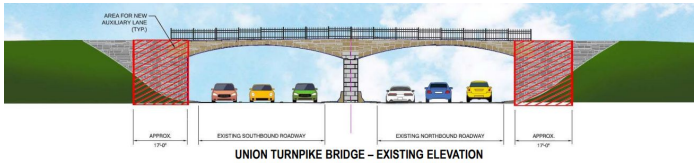


2. BRIDGE'S DESCRIPTION

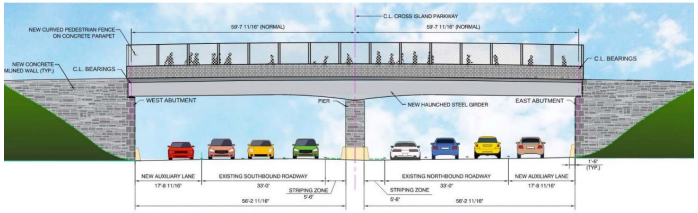
A. Brief description of the changes
B. Pictures of the bridge
C. Reasons for the proposal

A. BRIEF DESCRIPTION OF THE CHANGES

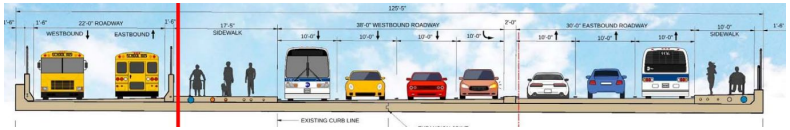
- **Location:** Intersection of interstate union Tpke and Cross island pkwy.
- **Scope of the work:** The existing bridge will be removed and replaced in its entirety with a new bridge
- **Utilities to be upgraded:**
  - water and oil pipelines
  - 4” electric ducts and 3” ducts
  - high pressure steel gas main.

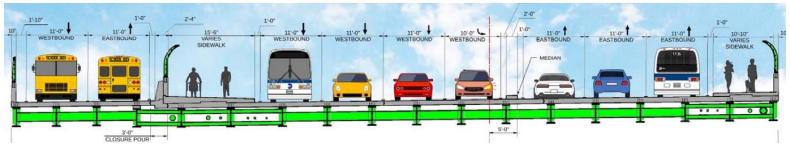


UNION TURNPIKE BRIDGE – EXISTING ELEVATION



UNION TURNPIKE BRIDGE – SCHEMATIC PROPOSED ELEVATION

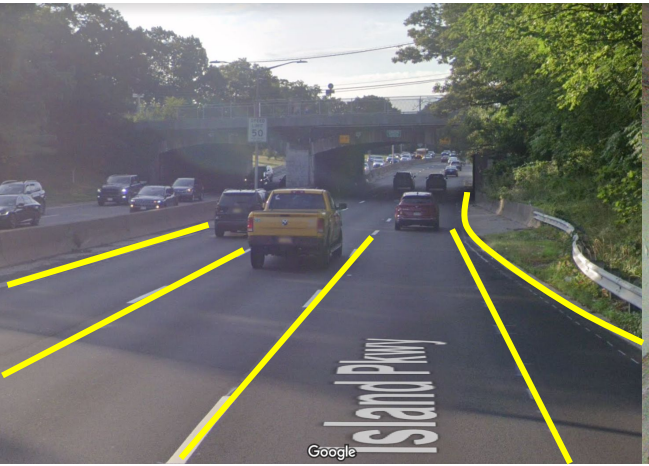




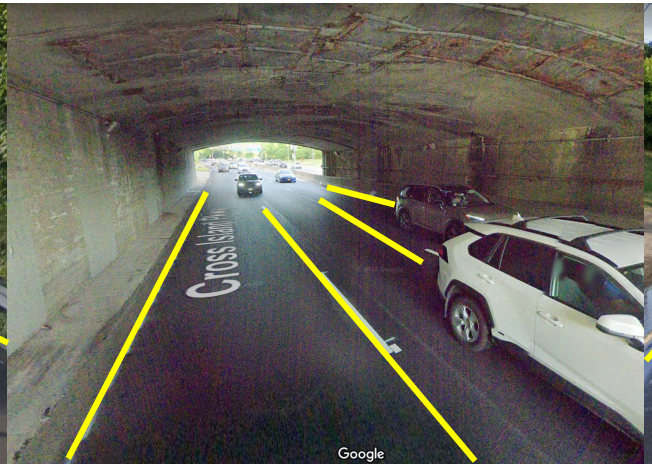
Existing and Proposed Bridge (DOT, 2022)

B. PICTURES OF THE BRIDGE

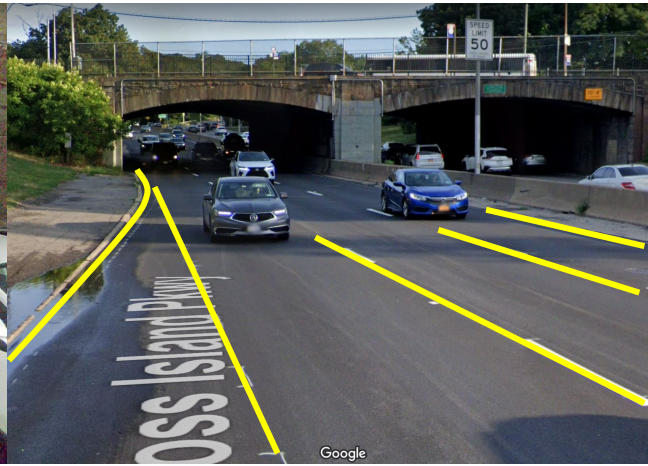
C. REASONS FOR THE PROPOSAL



Entrance of the tunnel
(4th Lane merging)



3 lanes in the tunnel



Exit of the tunnel
(4th Lane emerging)

One reason for the proposal of bridge's reconstruction is to allow the traffic from all the four lanes to pass through seamlessly. A digital twin model will enable the user to record traffic data for assessment of the bridge capacity.

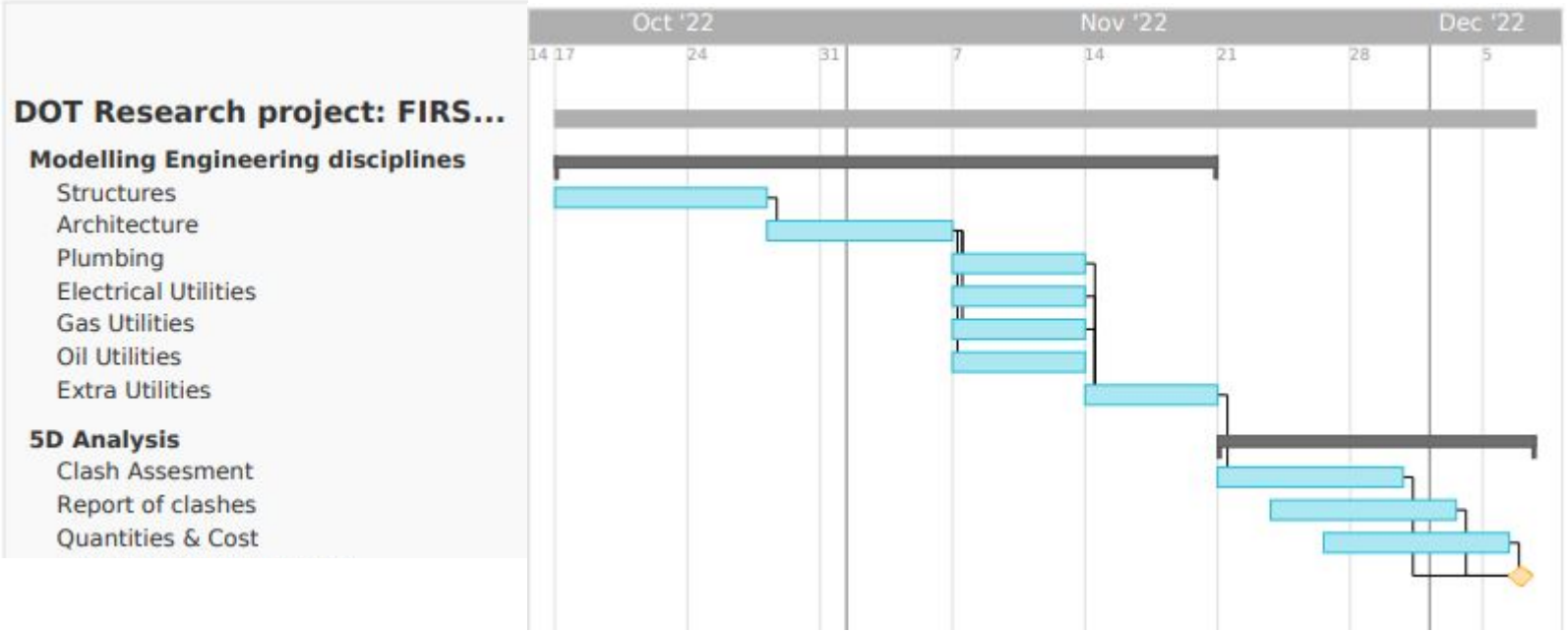
3. BIM EXECUTION PLAN

A. Section 01: Project Information
B. Section 02: Project Goals
C. Section 03: Collaboration
D. Section 04: Deliverables
E. Section 05: Model Quality
F. Section 06: Roles and WBS

A. Section 01: Project Information

- **Project Name:** Reconstruction of the Union Turnpike Bridge
- **Project Location:** Intersection of the Union Tpke & Cross Island Pkwy
- **Scope of Work:** 3D Modelling and schedule analysis of the construction of the new Union Turnpike bridge.
- **Standards to follow:**
    - NYC BIM Guide
    - UC San Diego BIM Guide
    - ISO 19650: Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)
- **LOD:** LOD 200 and 250 for the preliminary phases, LOD 350 for the final product

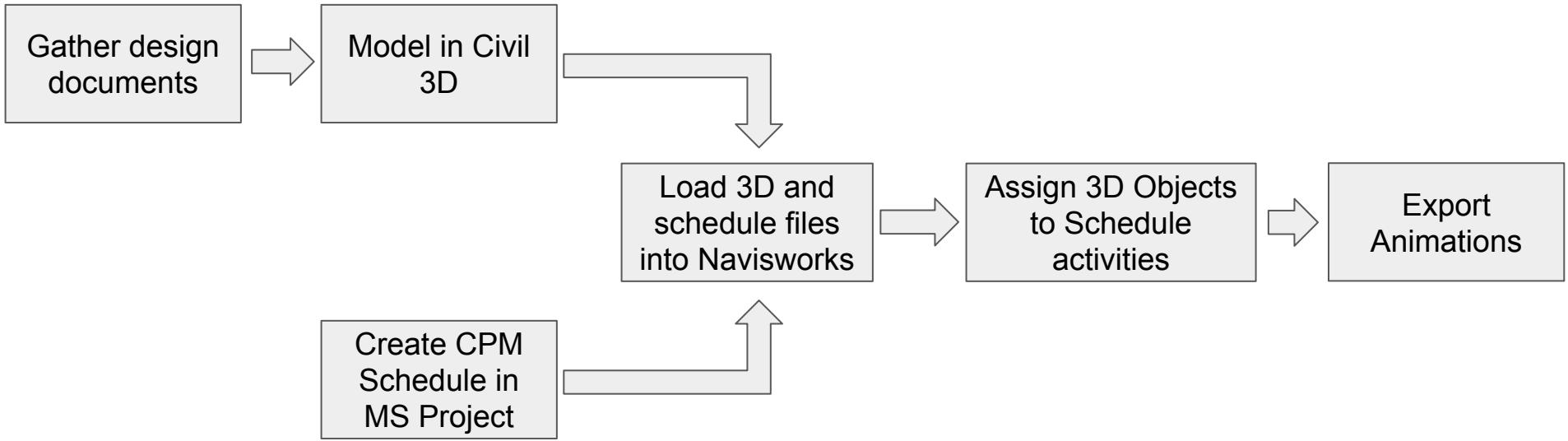
A. Section 01: Project Information - Schedule



B. Section 02: Project Goals (First Part)

- Complete the BIM models per engineering disciplines according to the current structure of the bridge.
- Link the models to Navisworks to detect the possible clashes within the different engineering disciplines
- After detecting the clashes, subdivide the elements of the model to fit the construction process of the new bridge
- Assign a schedule to each element (by using MS project), to reproduce a construction simulation in Navisworks.

B. Section 02: Project Goals (First Part) - 3D and 4D Modeling Approach



C. Section 03: Collaboration - (First Part)

- **Document Manage System:** Google Drive
- **Collaboration Methods:**
  - Video Conferencing with the DOT team
  - Internal meetings for modelling coordination
  - Presentation every 3 weeks during the CBIPS sessions
- **Coordinate Units System:** According to the blueprints of the project
- **Meeting procedures:**
  - Kick off meeting
  - Coordination meetings: 1 per week
  - Meetings with DOT: 1 every 2 weeks
  - CBIPS: 1 every 3 weeks

C. Section 03: Collaboration - (First Part)

- **File names:** First three letters of the engineering discipline _ revision ‘000’ (e.g. STR_DOT_001)
- **Identification of disciplines:** Plumbing, Electrical, Gas, Oil, Galvanized pipes. Parameters are going to be assigned.

D. Section 04: Deliverables - (First Part)

List of deliverables:

- Structures model (STR_001) - Autodesk Civil 3D
- Architecture model (ARC_001) - Autodesk Civil 3D
- Plumbing model (PLU_001) - Autodesk Civil 3D
- Gas piping model (GAS_001) - Autodesk Civil 3D
- Electrical piping model (ELE_001) - Autodesk Civil 3D
- Oil piping model (OIL_001) - Autodesk Civil 3D
- Navisworks integration for clashes (CLA_001) - Autodesk Navis
- Navisworks with the construction simulation (SIM_001) - Autodesk Navis
- MS Project with the network activities and the milestones (SCH_001) - MS Project

E. Section 05: Model Quality - (First Part)

Quality Assurance Strategies:

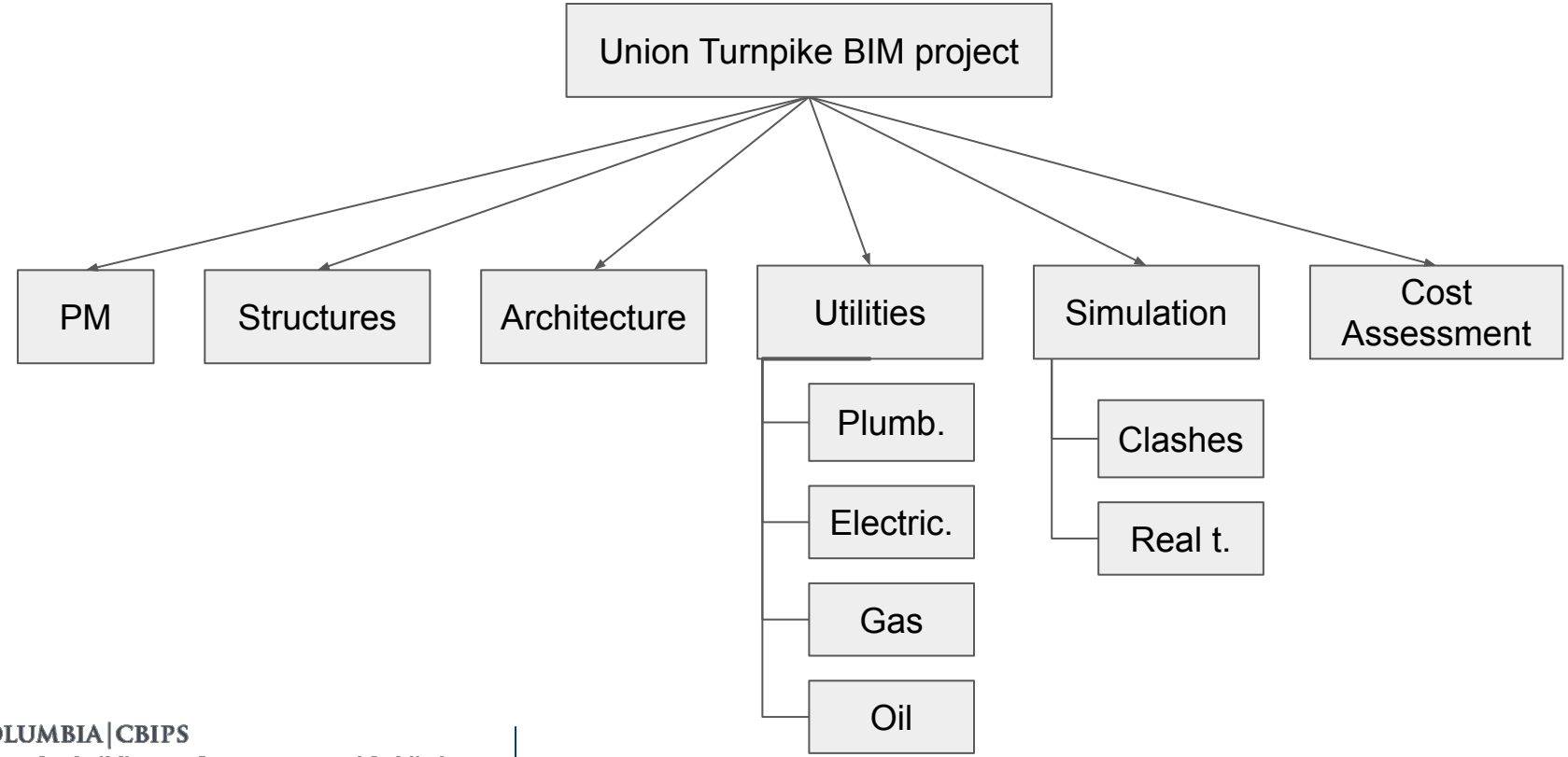
- Weekly meetings to overview the progress of the entire model
- Upload the files on drive so everyone in the CBIPS (DOT) / DOT has access to
- Link the models into Navisworks (Overlapping models)

E. Section 06: Roles and WBS

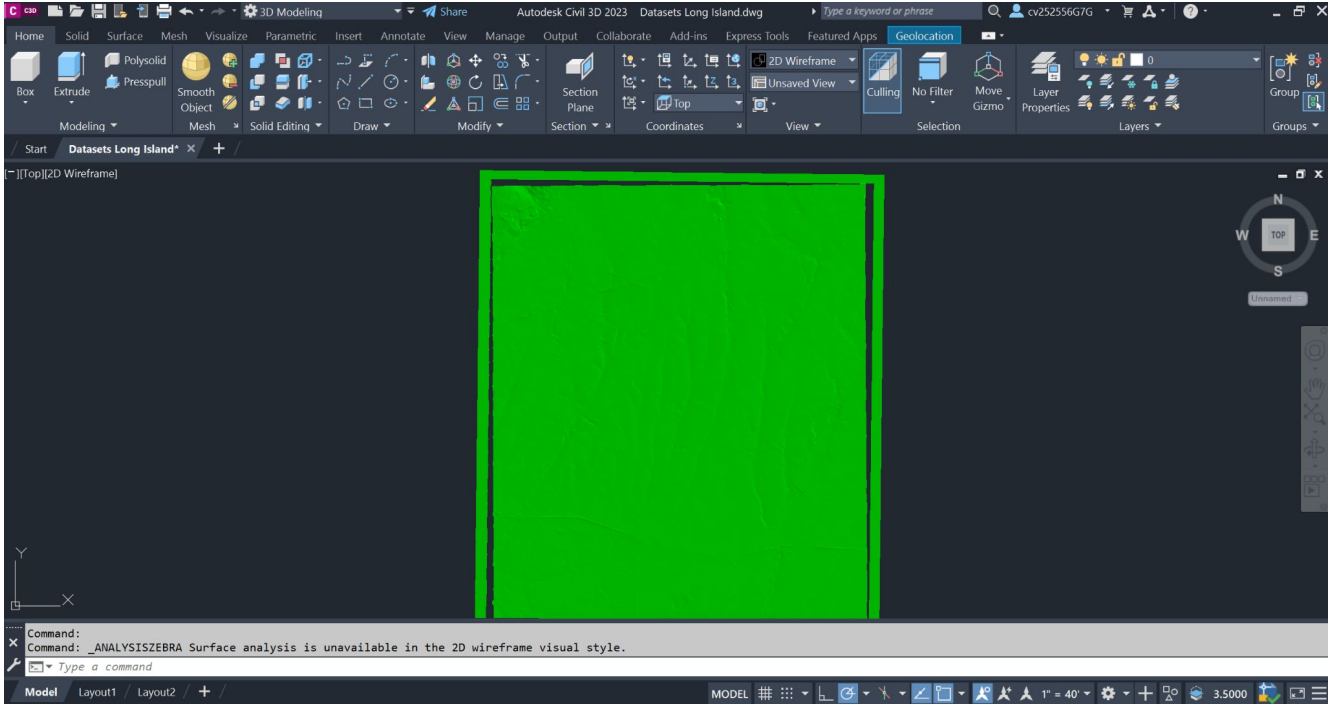
ROLES:

Structures Model	
Architecture Model	
Plumbing Model	
Gas piping Model	
Electrical piping Model	
Oil piping Model	
Navisworks clashes	
Navisworks simulation	
Ms Project Schedule	

E. Section 06: Roles and WBS



Current Progress with modelling



Importing DEM Dataset, which is a satellite ground imagery by LIDAR, which is given by the NYCDOT state.

Contour map for the site will be derived from this datasets and modelling of the bridge will commence on receipt of the record drawings and site visit.

https://gis.ny.gov/gisdata/quads/drg24/index.htm

References

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THANK YOU

CASE STUDY: UNION TURNPIKE BRIDGE

UNION TURNPIKE BRIDGE SITE VISIT & Record Plans

IN COLLABORATION WITH NYC DEPARTMENT OF TRANSPORTATION

CBIPS Studio – Mudd 706, Columbia University
November 1, 2022

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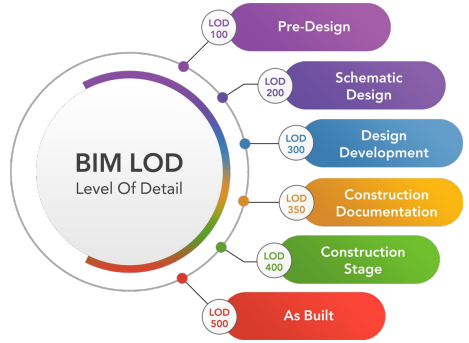
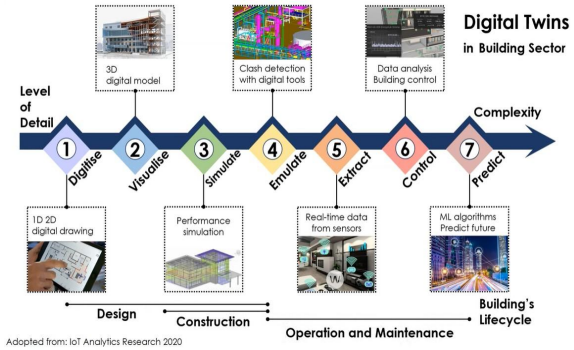
Last Presentation

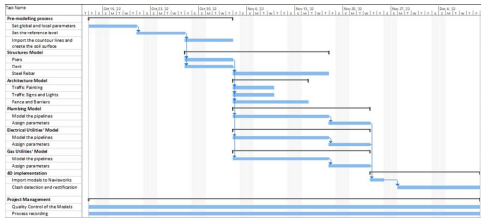
1. Literature Review
2. Description of the bridge
3. BIM Plan

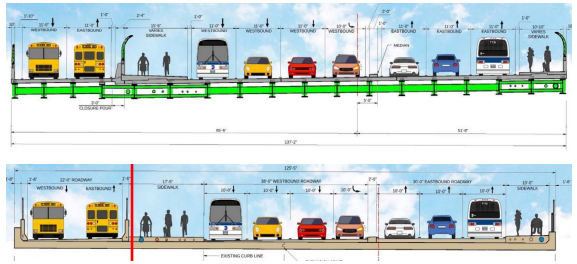


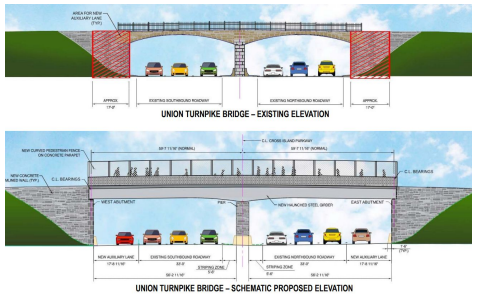
BIM Lod (Bimlead, ND)



Digital Twin in Construction (2022)







Existing and Proposed Bridge (DOT, 2022)

Outline

I. General Report of the Site Visit

II. Identification of Restrictions

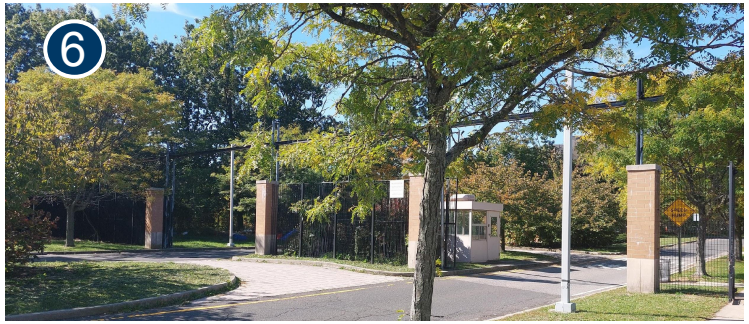
III. Files received from the DOT

IV. References

I. General Report of the Site Visit

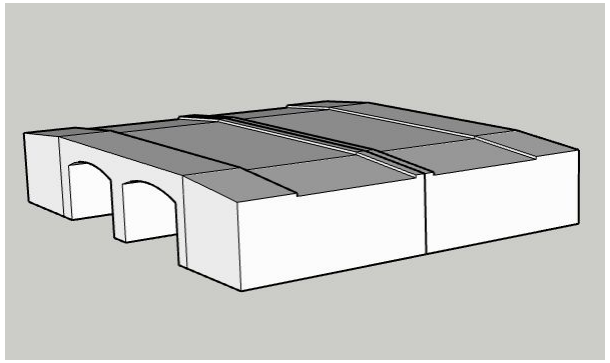
1. Site Visit **(10/12/2022)**
2. Review bridge's structures (Abutments, Joints, Piers, Slabs)
3. Identification of Signs: Bus stops, Traffic lights, Avenues, etc
4. Zones Relocation
5. BIM model for community engagement

1. Site Visit

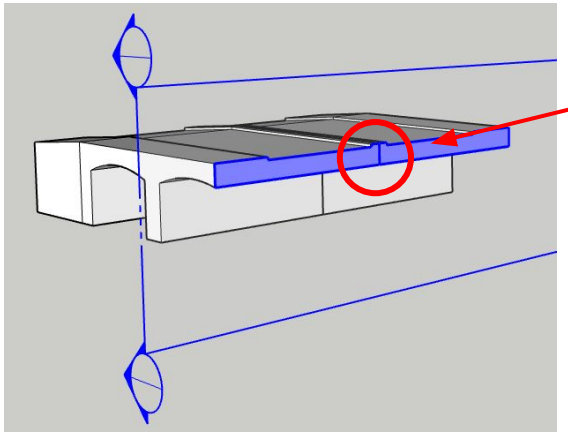


CBIPS research team_Site Visit_2022

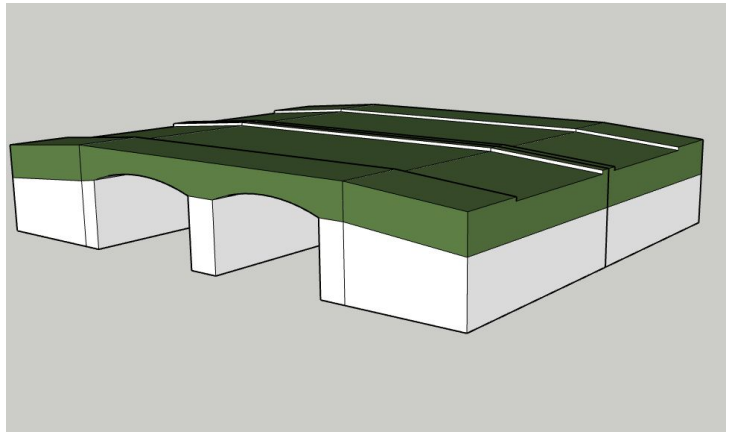
2. Review of the structures



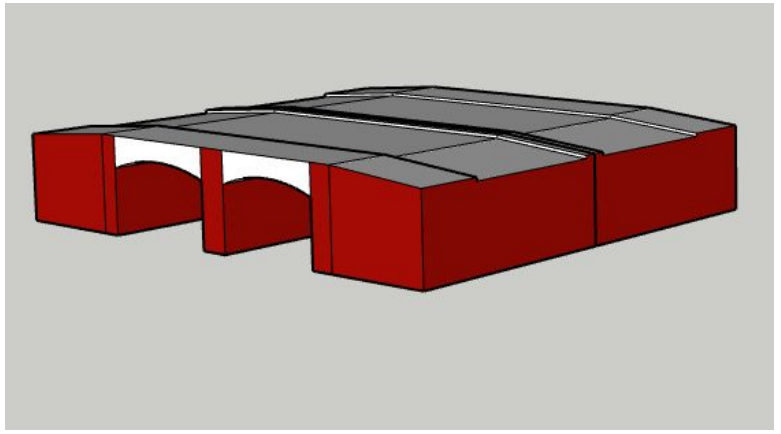
Preliminary 3D Modeling



Cut Section



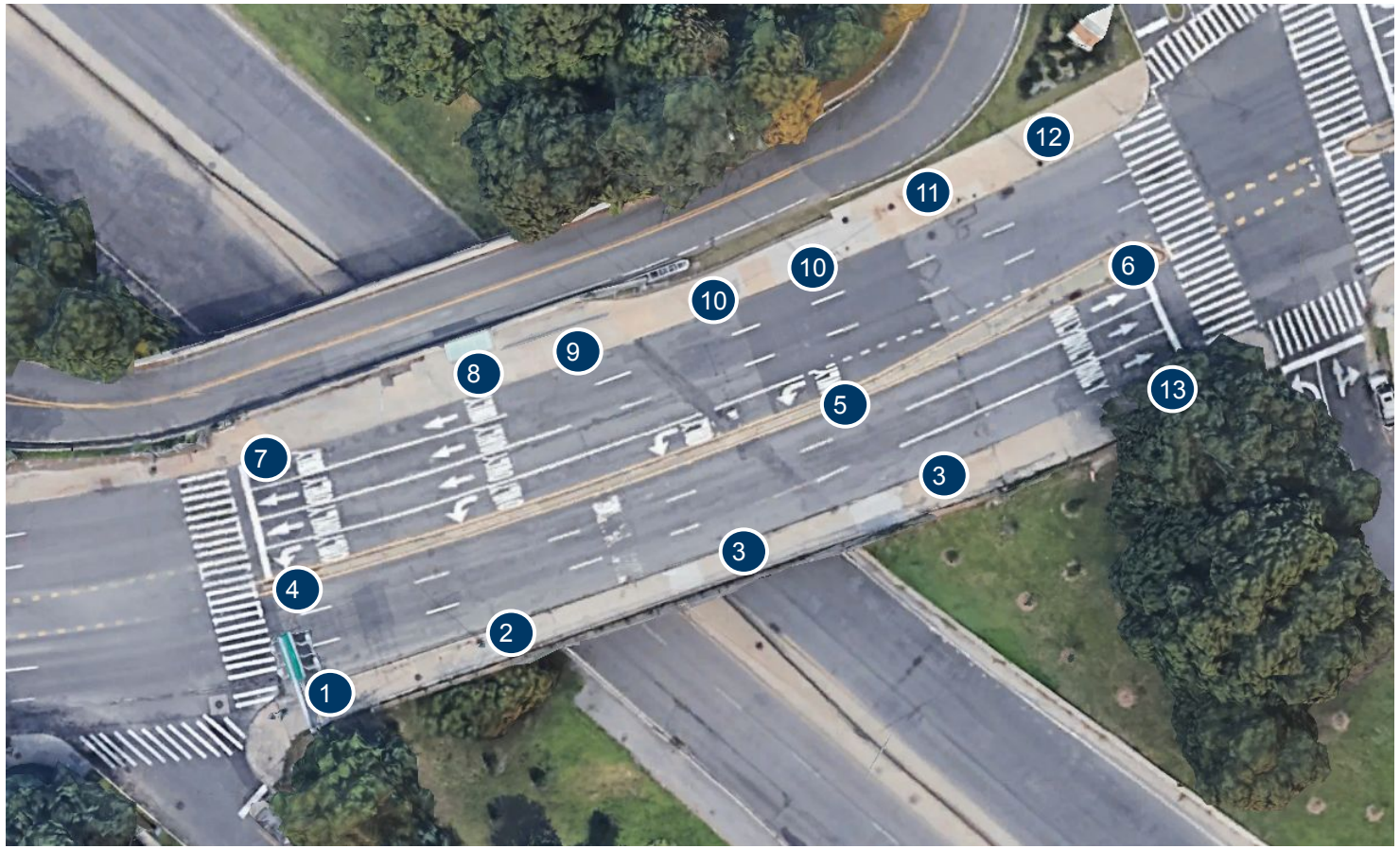
Concrete Slab



Piers

Preliminary 3D Modellings_Skechup, 2022

3. Identification of signs



CBIPS Research team_Identification of signs_2022

Legend

1. Avenue name
2. Bridge Light
3. No-Bus-Stop
4. Traffic Light
5. Bridge Light
6. Traffic Light
7. Bridge Light
8. Bus Stop
9. Bridge Light
10. Water Hydrant
11. Bridge Light
12. Traffic Light
13. Street name

4. Zones Relocation

- There is two bus stops on Union Turnpike bridge which will be relocated to nearest south end portion of bridge

- Side walk on western and eastren portion of bridge along cross Island parkway would be reduced to “3 feet”

CBIPS Research team_Bus stop Relocation_2022

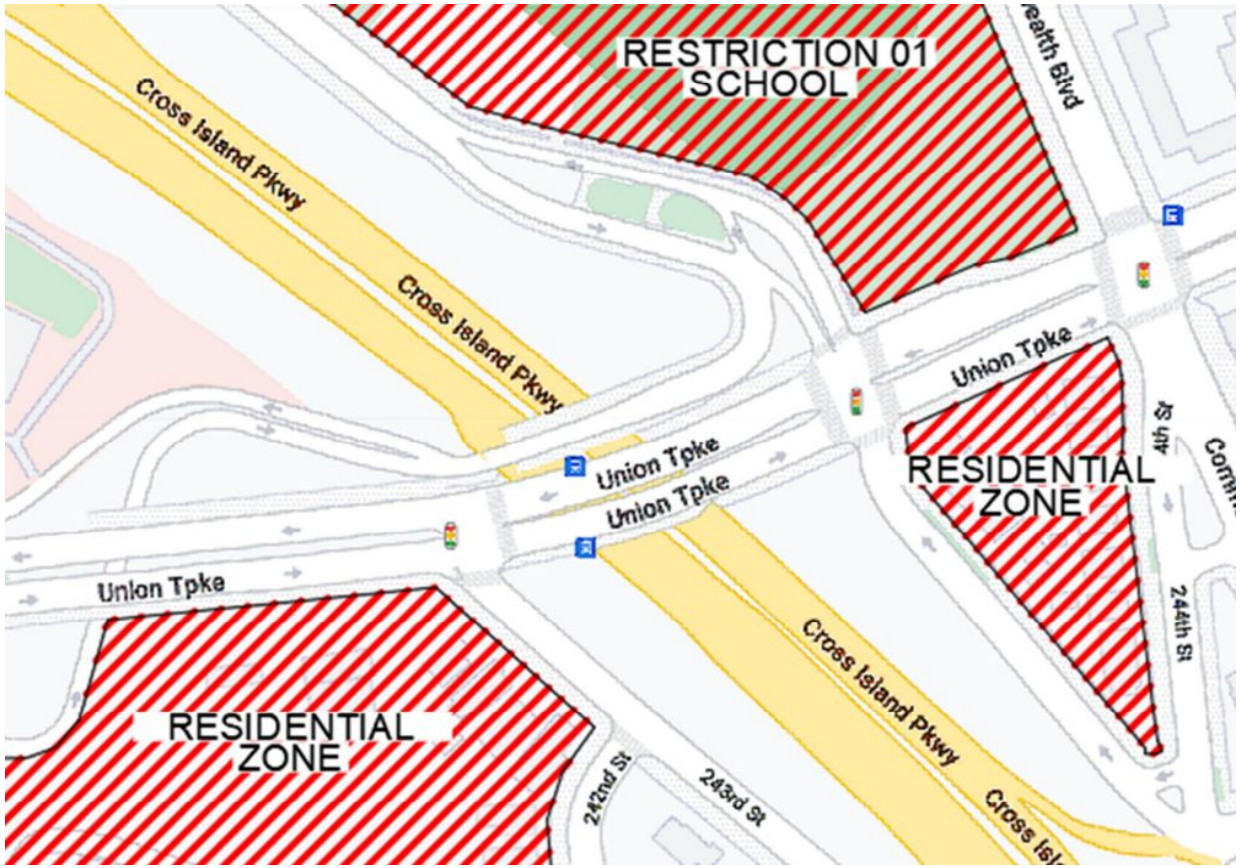
5. BIM Model for Community Engagement

- In order to deliver a better communication and understanding to the community, a BIM model plays an important role.
- Creating the 3D model, will help people visualize the changes been made and what benefits will it bring to the existing community.
- A construction simulation which will be aggregated to the model will also help them understand the different stages of construction and areas which will be under direct influence of the construction activities

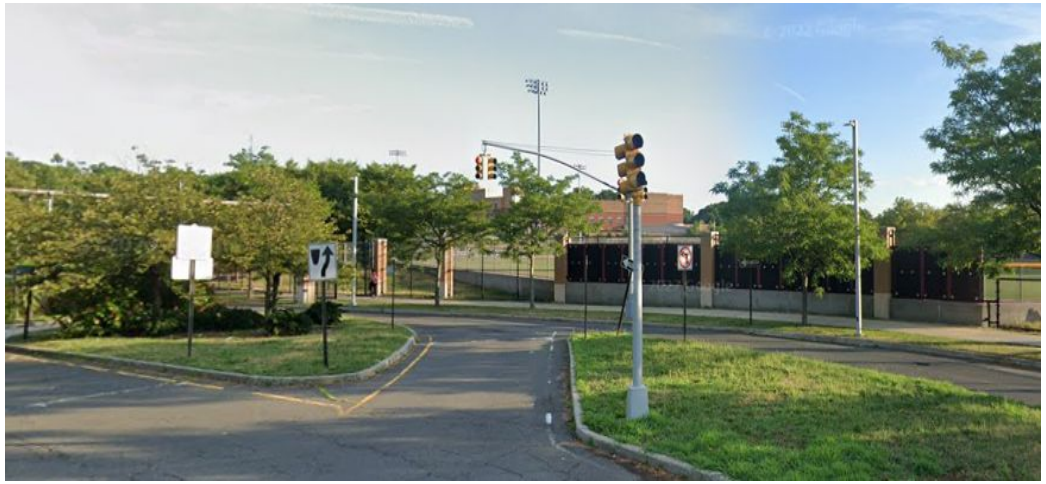
II. Identification of Restrictions

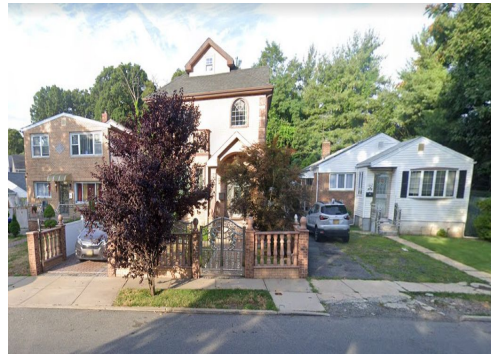
1. Critical Zones
2. Stakeholders Affected
3. Piping in the Bridge
4. Traffic Condition

1. Critical Zones



Buildings and infrastructure next to the bridge



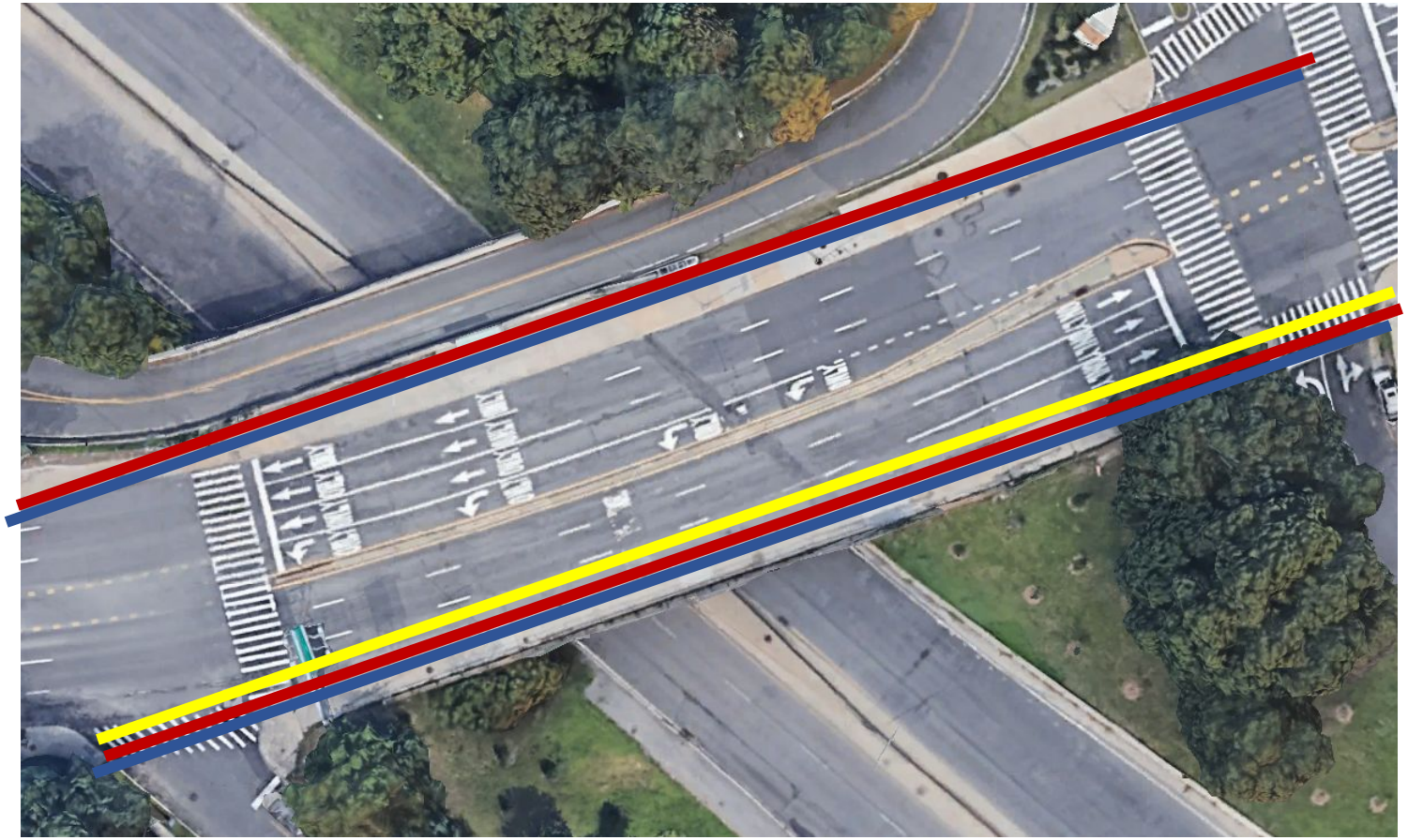


CBIPS research team_Site Visit_2022

2. Stakeholders Affected

1. Neighbors from the critical zones
    a. School
    b. Creedmoor Hospital
    c. Residential Buildings
2. The residents who use the utilities that pass through the bridge
3. Sidewalk use by residents (the width is going to be reduced during the construction)

3. Piping within the Bridge



1939_Utilities of existing bridge

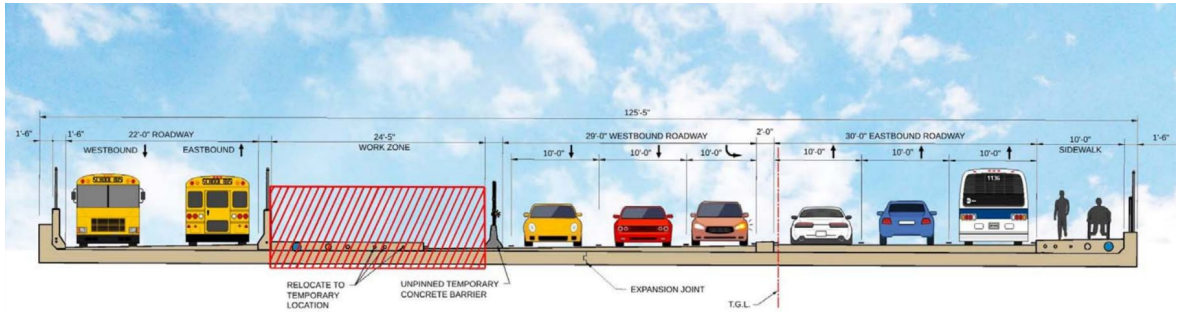
Utilities in the Bridge

- Gas piping
- Electrical
- Pipe line
- Communication

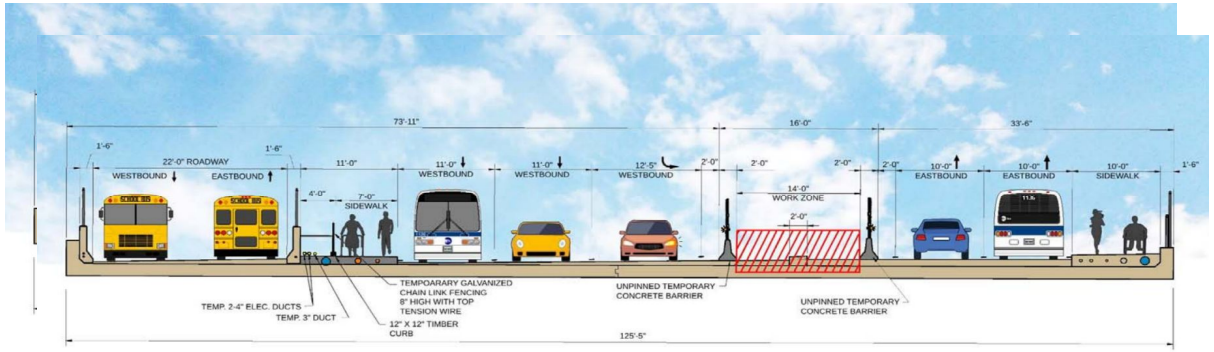
nationalgrid
conEdison

4. Traffic Condition

- 7 lane Bridge (3 Eastbound + 4 Westbound lanes)
- Significant amount of traffic (Private vehicles, School bus and Q46 MTA bus)
- Sidewalks for pedestrians (2)
- Staged Construction

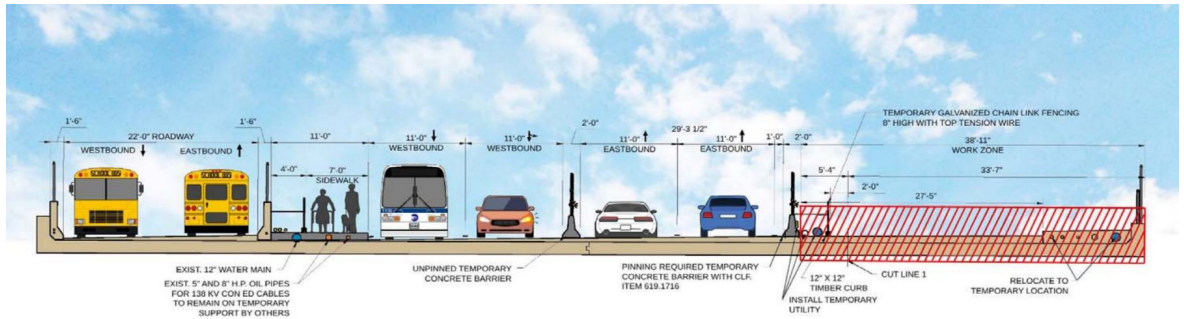


Stage 1

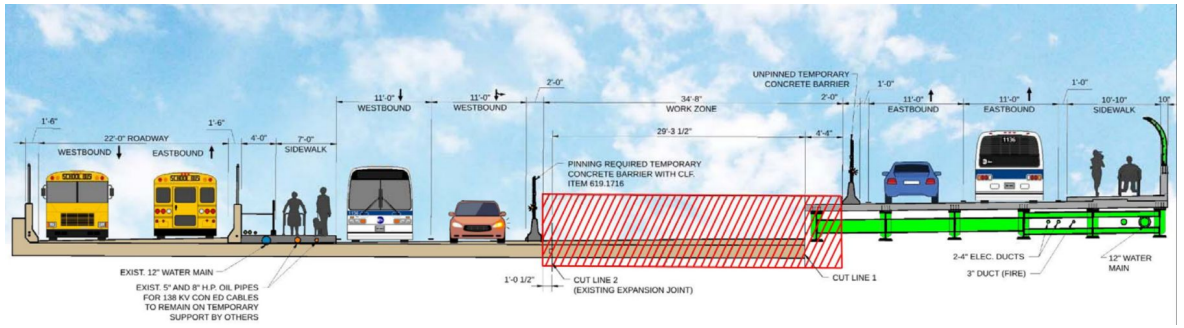


Stage 2

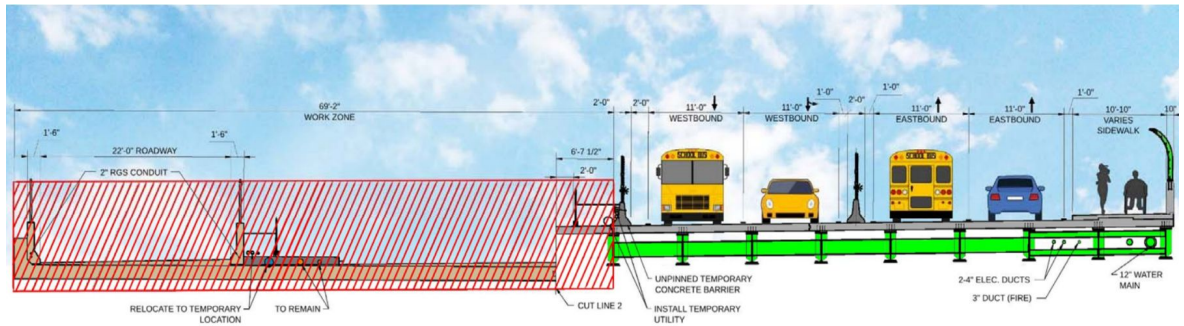
4. Traffic Condition Continued…



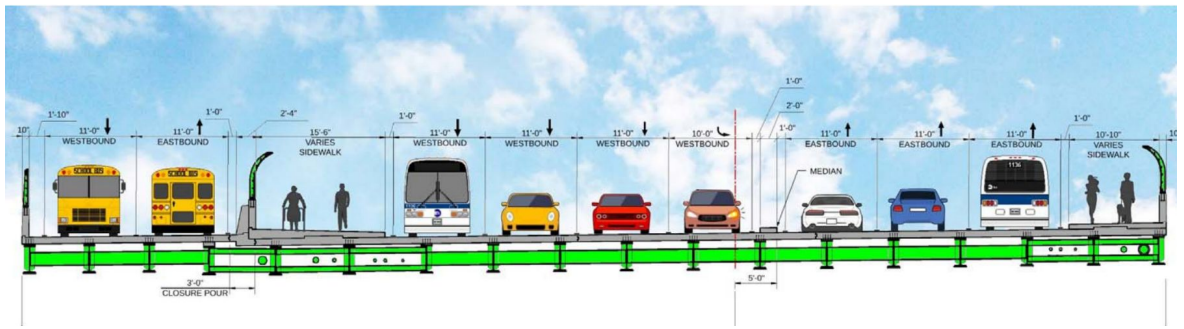
Stage 3



Stage 4



Stage 5



Stage 6

6. Tree Restrictions

- Cut of existing trees in the area
- Plantation of new trees to reduce the environmental impact

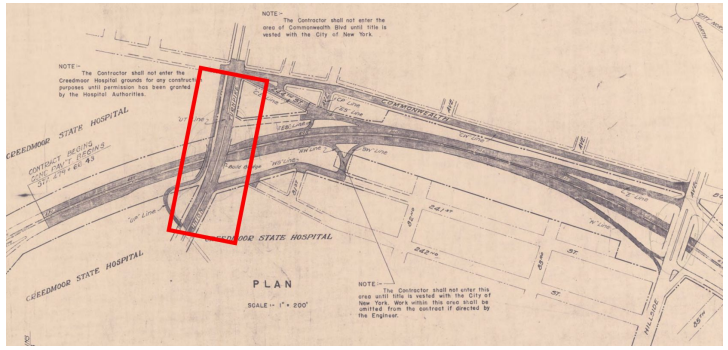
CBIPS Research team_Tree restoration_2022

III. Files Received from the DOT

1. General Description
2. List of Blueprints
3. Record Plans-Utilities Location
4. Key Findings

1. General Description

1. Contract NO SC 39-12: Separation of the grades at union turnpike
2. Union Turnpike was part of the scope for the bridge
3. 28 plan views and elevations (#8 is missing)
4. Plans approved on 20th April 1939

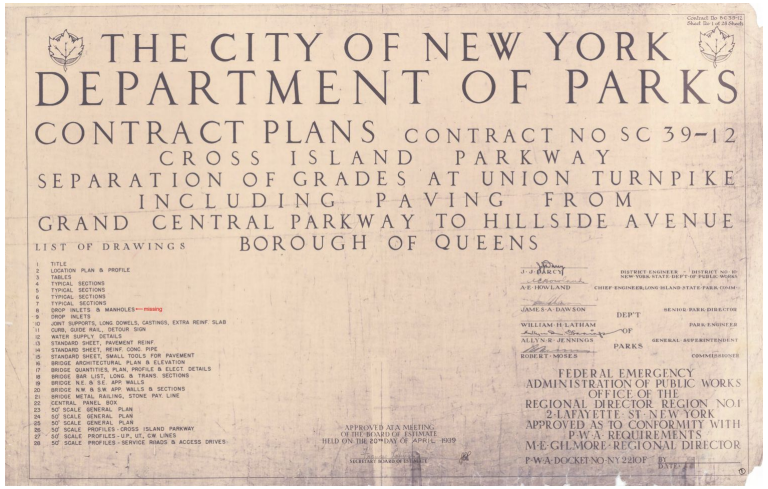


Scope of the project (DOT,1939)

5. Elevations based on the Queen Borough Datum (2.725 ft a.m.s.l)

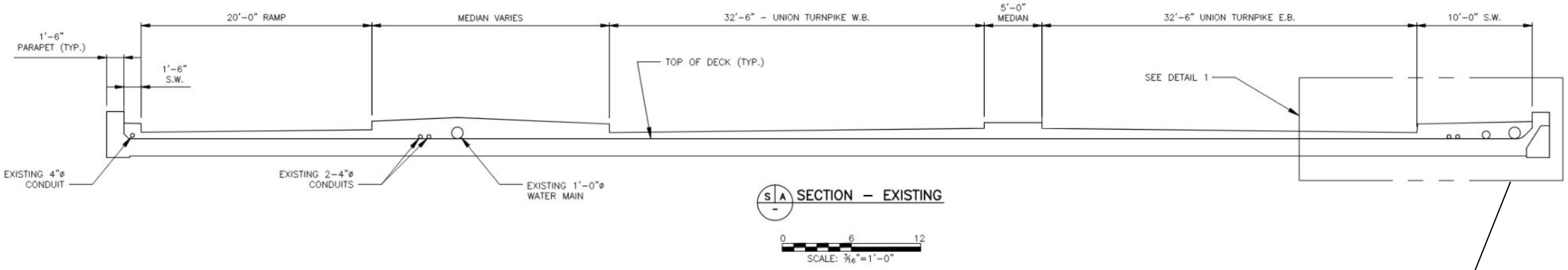
2. List of Blueprints

1. Blueprints: 1-27, structures and architecture
2. Blueprints: 28-29, plan view and section
3. Blueprints: 30-32, deck inspection findings
4. Blueprints: 33-34, elevation inspection findings
5. Blueprints: 35-40, utilities
6. Blueprints: 41-42, fence and barriers
7. Blueprints: 43-44, topographic survey of the deck
8. Blueprints: 45-52, existing structure and construction plan

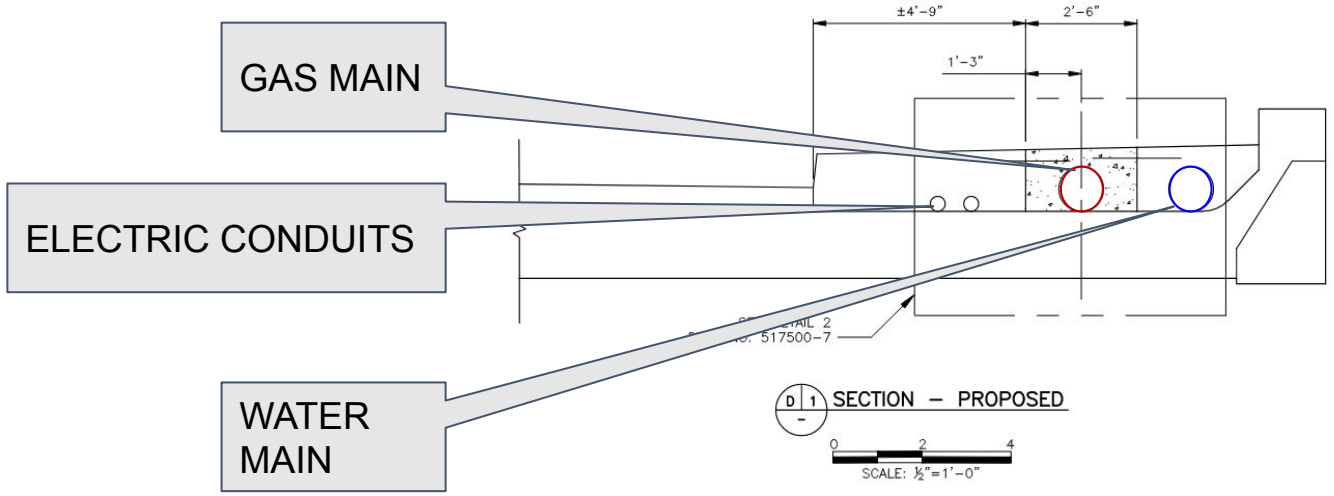

THE CITY OF NEW YORK
DEPARTMENT OF PARKS
CONTRACT PLANS CONTRACT NO SC 39-12
CROSS ISLAND PARKWAY
SEPARATION OF GRADES AT UNION TURNPIKE
INCLUDING PAVING FROM
GRAND CENTRAL PARKWAY TO HILLSIDE AVENUE
BOROUGH OF QUEENS
LIST OF DRAWINGS

First page of the plans (DOT,1939)

3. Record Plans-Utilities Location



- 8” Gas Pipe replaced by 12” Gas Main



Record Plans By NYCDOT

4. Record Plans-Key Findings

1. Design approved on 20th April 1939 by Department of Parks
2. Designed using a load of 1-20 ton truck preceded and followed by 15-ton trucks
3. Repair and rehabilitation of deck in 1999
4. Roadway Lighting plan was updated in 2003
5. 8” Gas Main was replaced by 12” dia. Gas Main in 2017

IV. References (1)

- Paul, Shimonti. “What Is Bim?” Geospatial World, 17 Sept. 2020, https://www.geospatialworld.net/blogs/what-is-bim/
- Davis, Meg. “Road and Bridge Digital Twins in Action: Four Case Studies.” Cadalyst, 29 May 2020, https://www.cadalyst.com/collaboration/digital-twin/road-and-bridge-digital-twins-action-four-case-studies-75827
- BIMLEAD. “Bim Lod: Bim-Lead.” BIM, https://www.bim-lead.com/services/bim-lod/.
- Bertin, Ingrid, et al. “A BIM-Based Framework and Databank for Reusing Load-Bearing Structural Elements.” Sustainability, vol. 12, no. 8, 2020, p. 3147., https://doi.org/10.3390/su12083147.

IV. References (2)

- “Digital Twin in Construction.” YouTube, YouTube, 7 Mar. 2021, https://www.youtube.com/watch?v=e1wfpD0OYxA&list=RDLVe1wfpD0OYxA&start_radio=1. Accessed 11 Oct. 2022
- “Digital Twin Bridge Saves Real-World Sibling”, YouTube, Oct 26, 2021 https://www.youtube.com/watch?v=b6heGJknCvw. Accessed 10 Oct. 2022.
- Zhou, Chenyu & Xiao, Dahai & Hu, Jianghan & Yang, Yuntao & Li, Binbin & Hu,, Simon & Demartino, Cristoforo & Butala, Mark. (2022). An Example of Digital Twins for Bridge Monitoring and Maintenance: Preliminary Results. 10.1007/978-3-030-91877-4_129.
- Ye, Cong & Butler, Liam & Calka, Bartek & Iangurazov, Marat & Lu, Qiuchen & Gregory, Alastair & Girolami, Mark & Middleton, Campbell. (2019). A Digital Twin of Bridges for Structural Health Monitoring. 10.12783/shm2019/32287.

Thank You

If you have any questions, suggestions, and recommendations