

An Atlas of Dust

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Research Question: Is it possible to map, document, isolate and visualize in 3D the layers of dust encrusted on building facades? If so, can we recognize discernable patterns of how the dust settled on the facades? What can these dust patterns teach us about the history of the weather and environmental pollution? Can we learn to read buildings as long-term environmental sensors encrypted with valuable material data about pollution?



The air today is a lot cleaner than during the past century, yet long term environmental data is encrusted on facades. Students will learn to read architecture as a long term environmental sensor



<https://sketchfab.com/3d-models/avery-hall-north-facade-81b737d3deb64fafa5e047b7237f2afd>

Students will learn how to process the data into 3D models viewable online.



Data Processing LiDAR, terrestrial and aerial photogrammetry of the site is aligned with precise GPS control to create a single 3D photo-textured surface model which can then be used as a basis for producing derivatives and further analysis. **Video Credit: CyArk Foundation**

Students will experiment with various digital imaging techniques to isolate the layers of dust on the buildings so they can be visualized independently.



ISOLATED DUST SOILING ON LIMESTONE - ELEVATION

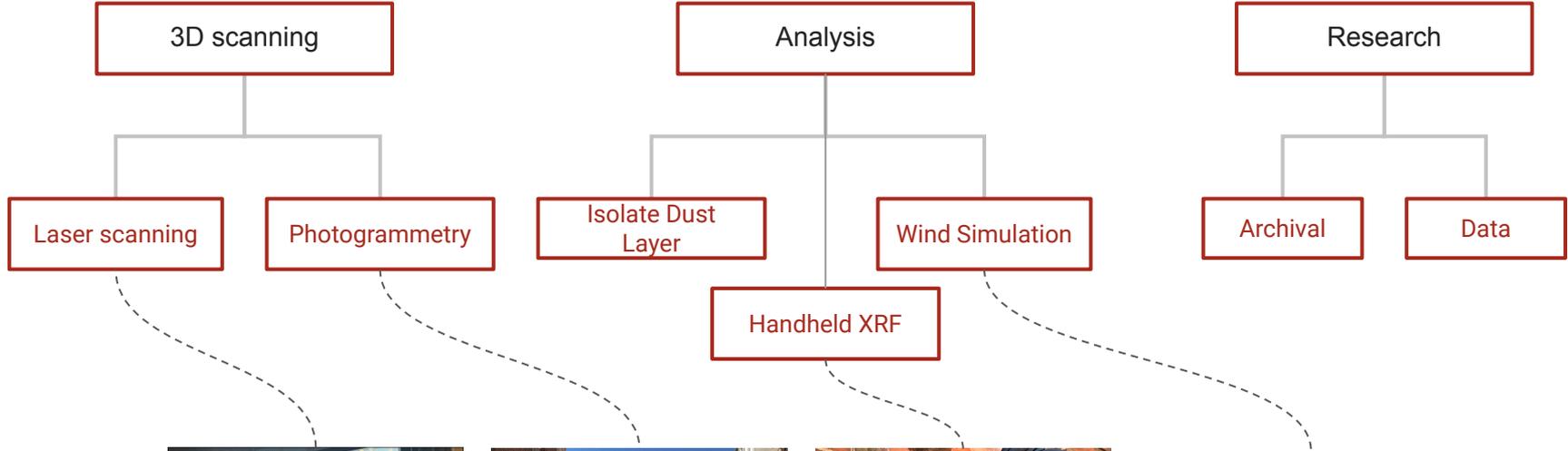


Isolated Limestone Dust

This is a version of the [North Facade of Avery Hall 3D scan](#) that attempts to isolate the accumulated dust on the limestone. The results are imperfect, but the model can still tell us a few things about soiling patterns.

ISOLATED DUST SOILING ON LIMESTONE - 3D

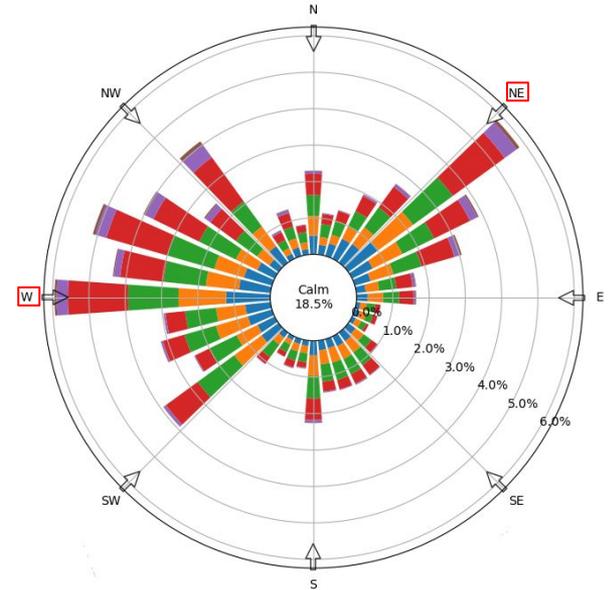
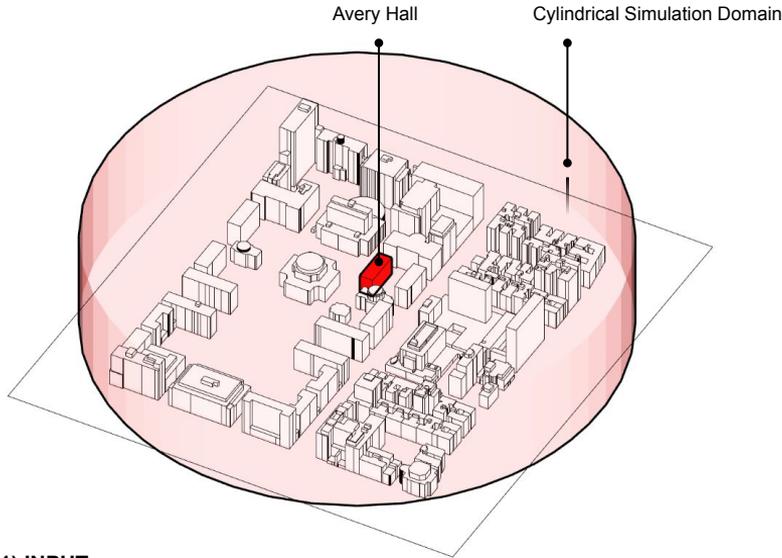
Methodology



Students will work in the Preservation Technology Lab where they will process the data gathered in the field.
There will be tutorials to teach the various software programs necessary to process and visualize the data.
Students will make use of the lab's library of historic materials and building fragments.



Students will learn to analyze and interpret dust patterns by correlating the 3D maps of dust with historical weather and pollution information, including prevailing winds, yearly rainfall, and historical air quality data.



Wind Rose Diagram(1970-2021)

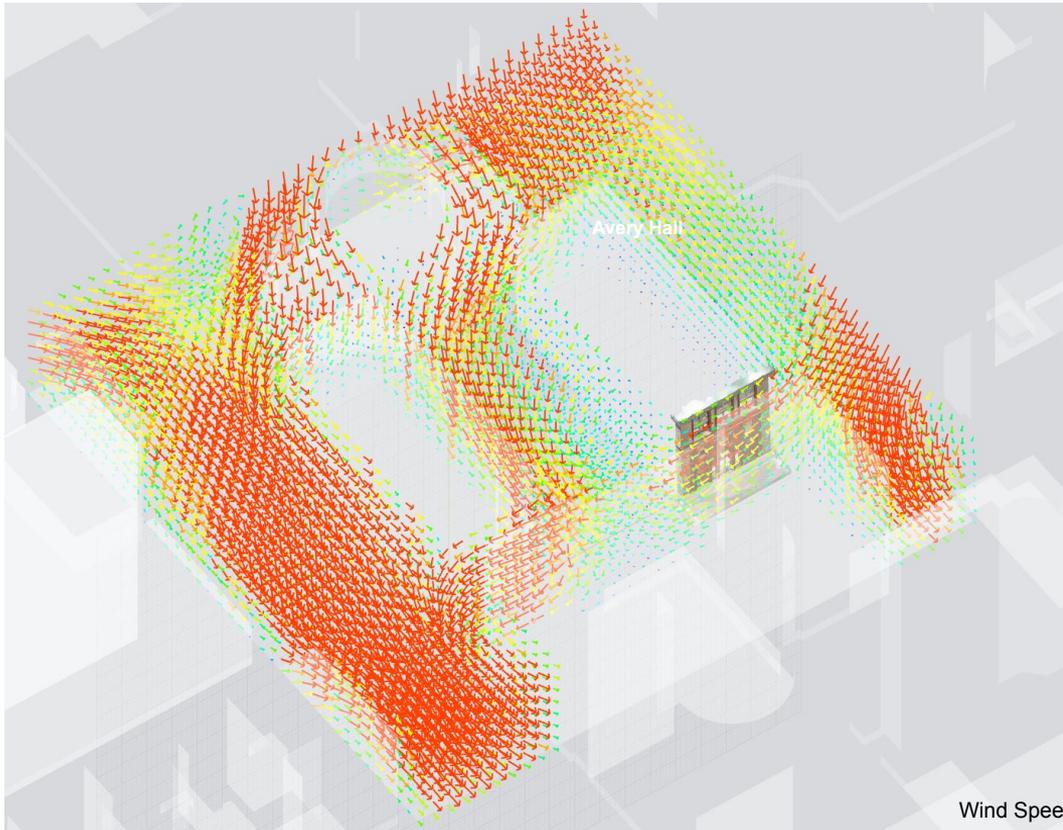
(NY_ASOS Network, Central Park Station.)

1) INPUT

- EPW file: Climate data (**TMY3_Central Park_1976-2005**) from **energyplus.net** website
- Geometry: 85 buildings around Avery Hall + Terrain
- Simulation Domain: Cylindrical Domain (Radius: 640M, Height: 130M)
- Wind direction: 0(N), **45(NE)**, 90(E), 135(SE), 180(S), 225(SW), **270(W)**, 315(NW)



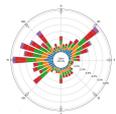
Students will learn to analyze and interpret dust patterns by correlating the 3D maps of dust with historical weather and pollution information, including prevailing winds, yearly rainfall, and historical air quality data.



Wind Speed



W



WIND SIMULATION

0.01m/s

6m/s



NE

Average wind speed from all 8 directions

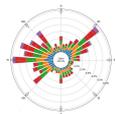
W

Wind Speed



0.01m/s

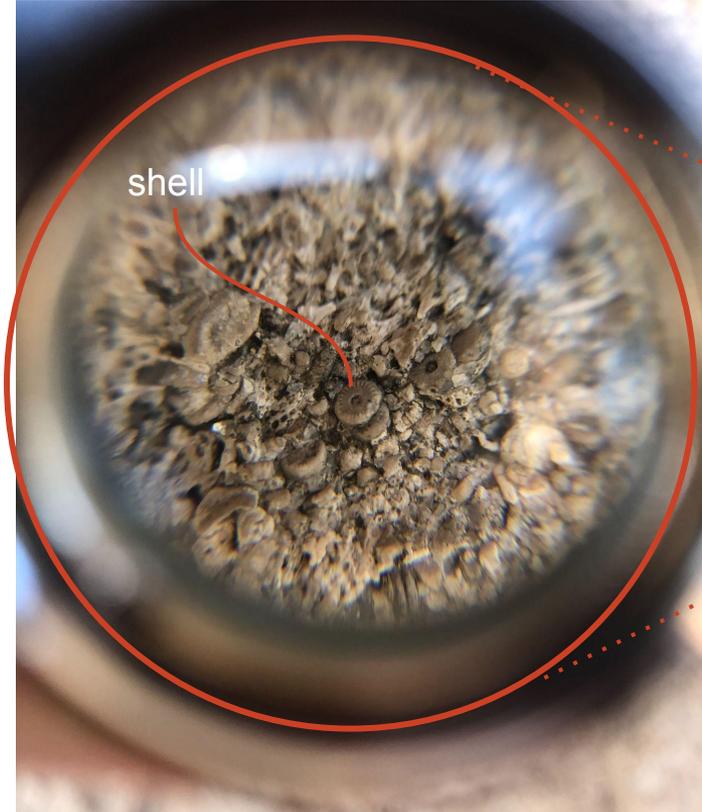
6m/s



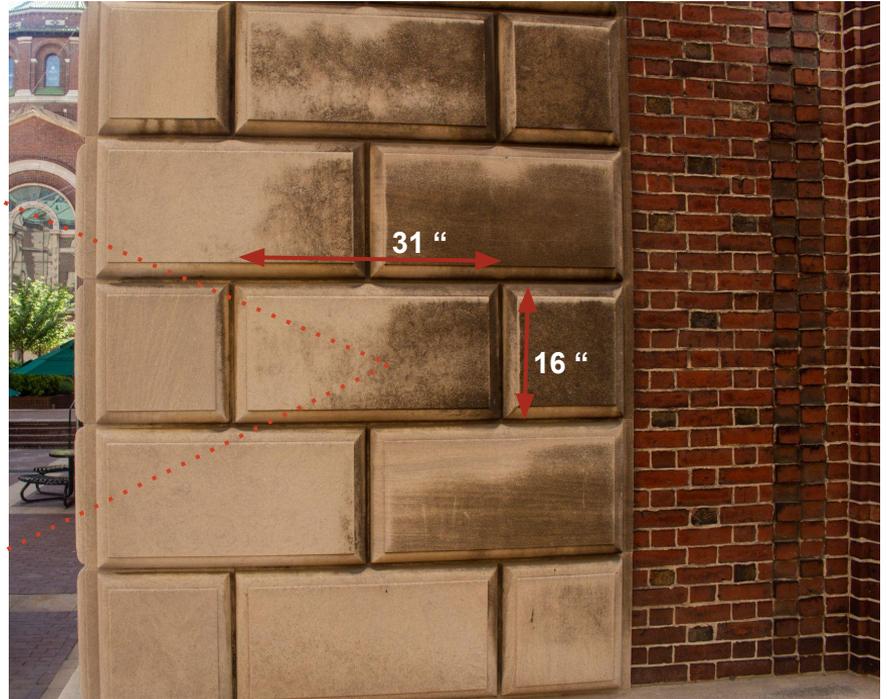
Students will learn the value of looking at buildings up close



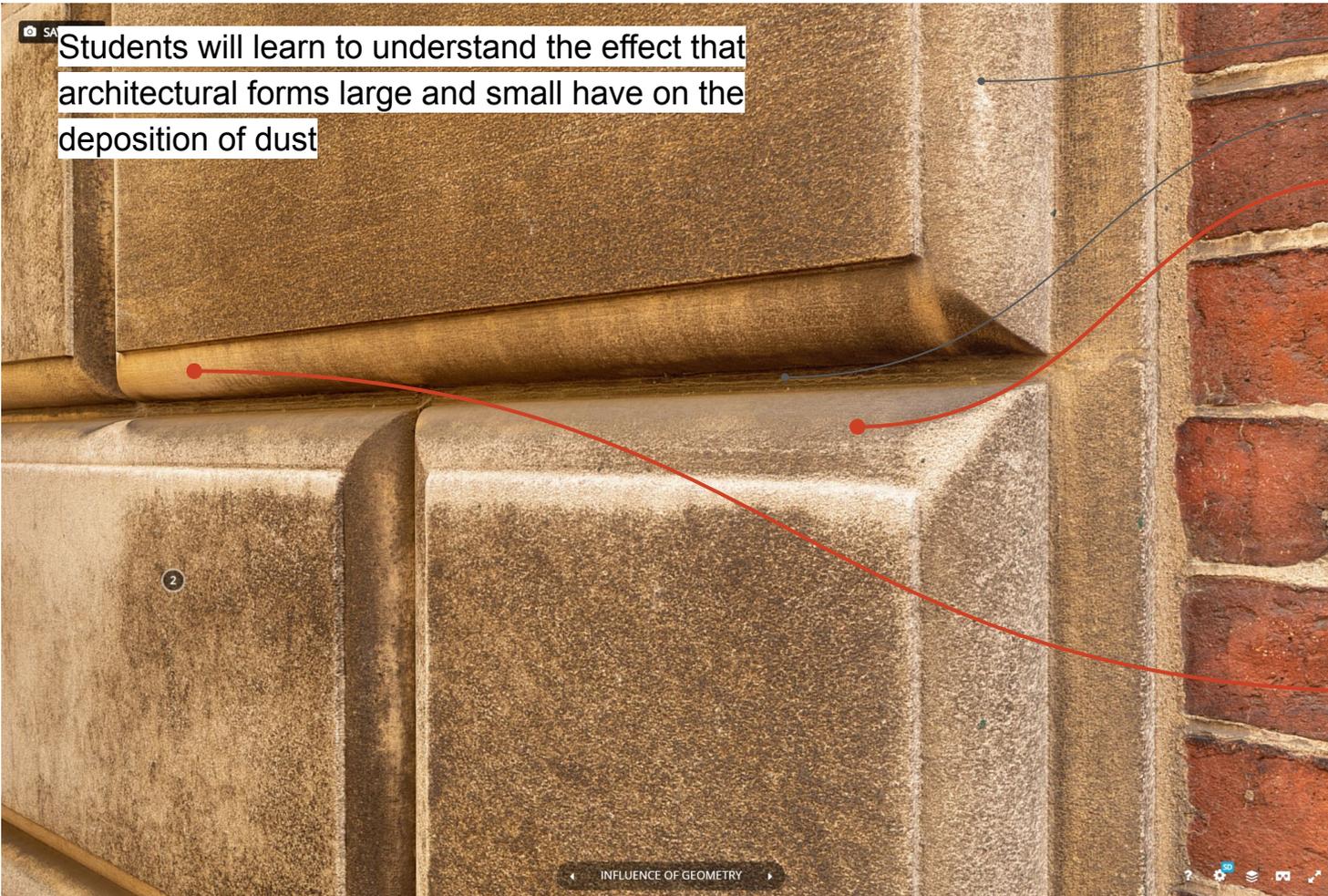
Students will learn basic materials science and chemistry to understand the kinds of chemical reactions that lead to the formation of dust layers on the surface of buildings. They will also learn to use microscopes and other equipment to document and verify scientific principles in the field.



Lupe Magnification 10x



Northeast Facade of Avery Hall



Students will learn to understand the effect that architectural forms large and small have on the deposition of dust

Thickness 1 3/4"

Horizontal Joint with 1/2" Gap

Gypsum Accumulation on a Surface sheltered from the Rain

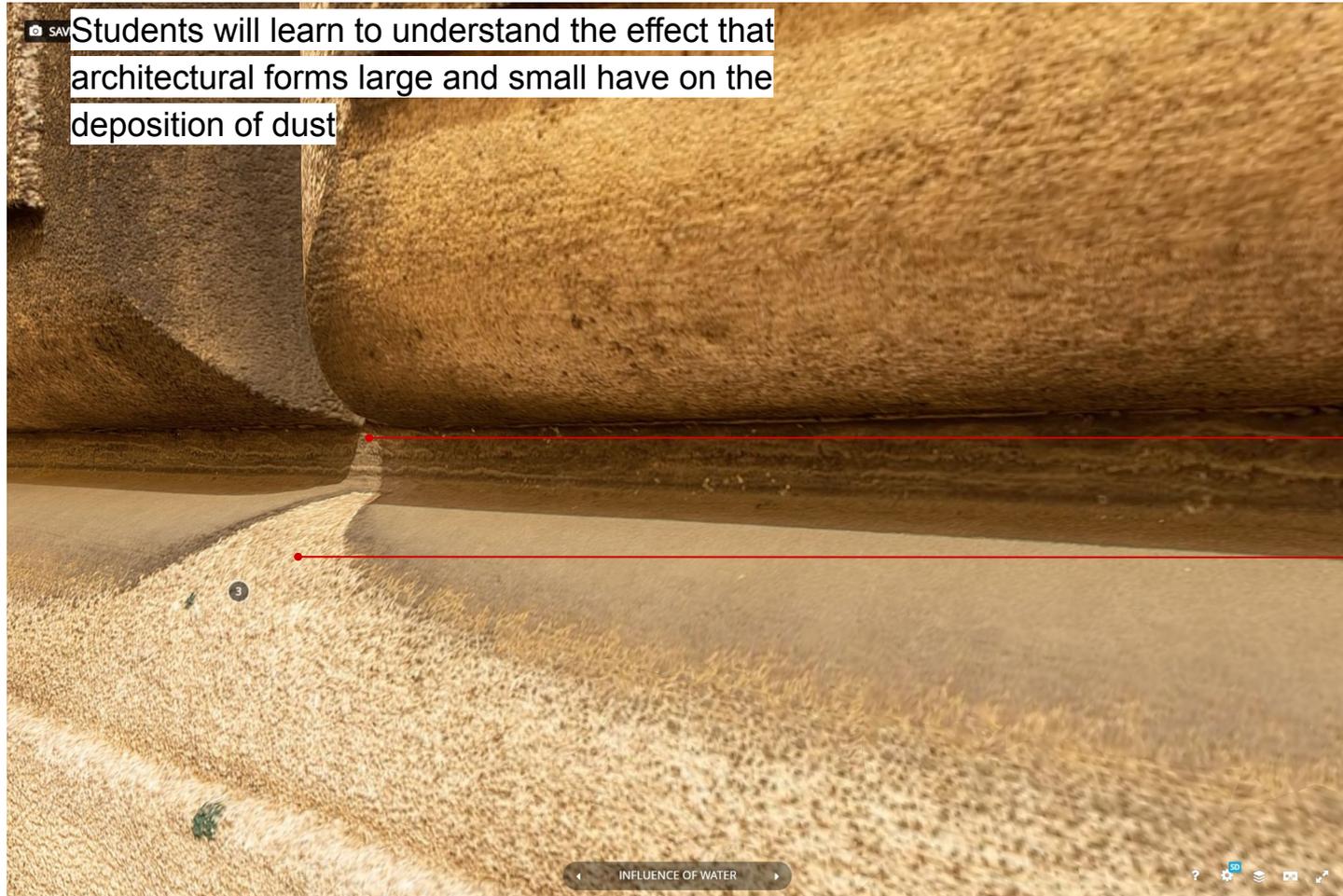
An Area Easily washed off by the Rain

2

INFLUENCE OF GEOMETRY

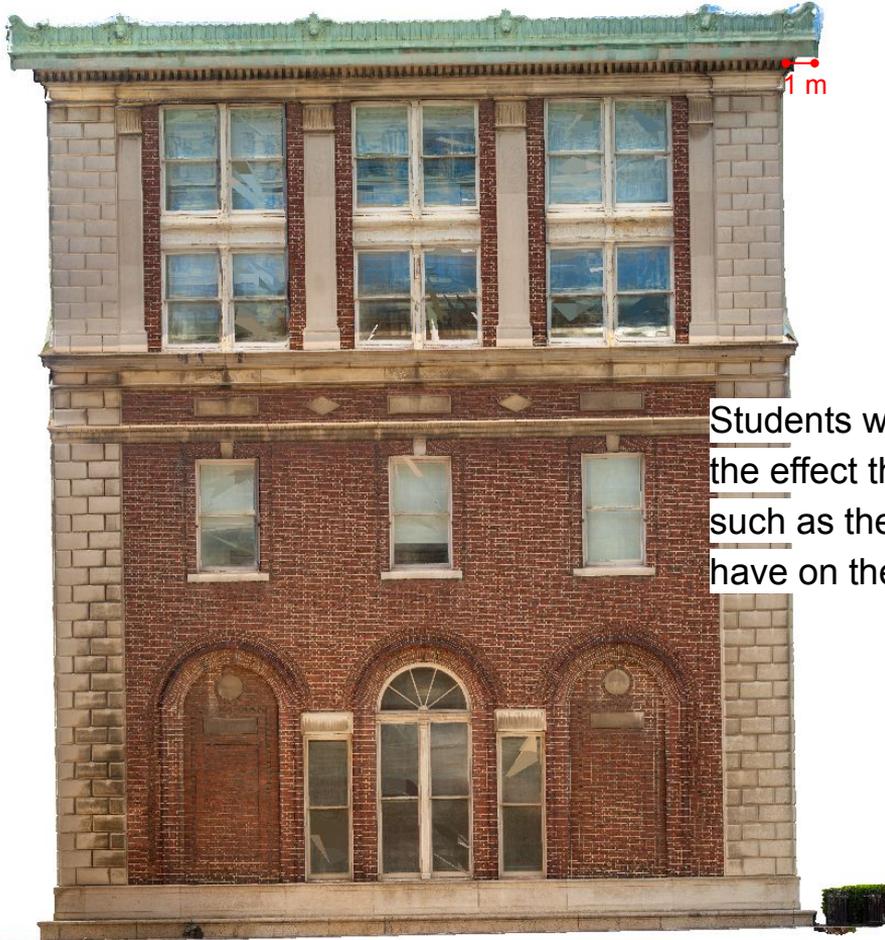


Students will learn to understand the effect that architectural forms large and small have on the deposition of dust

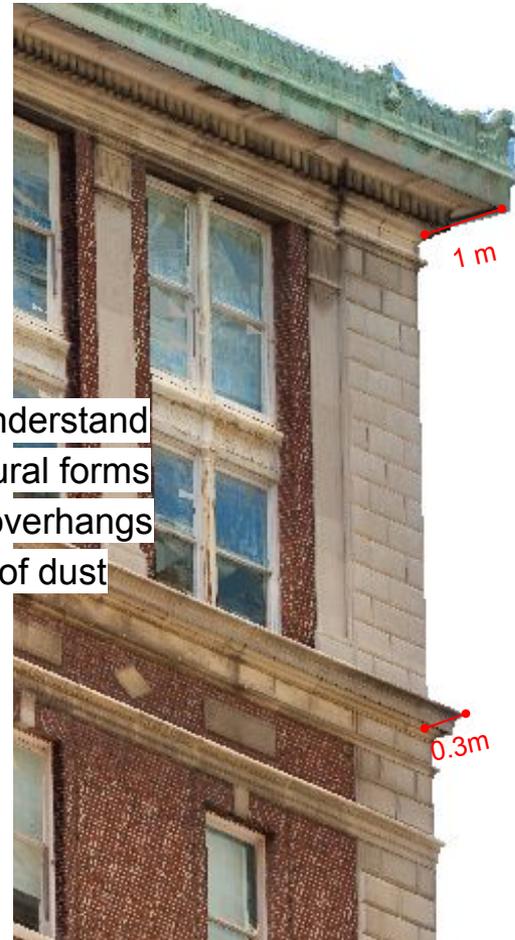


Vertical Joint with 1/2" gap becomes water runoff channel

Rainwater Wash-off Pattern



Students will learn to understand the effect that architectural forms such as these cornice overhangs have on the deposition of dust

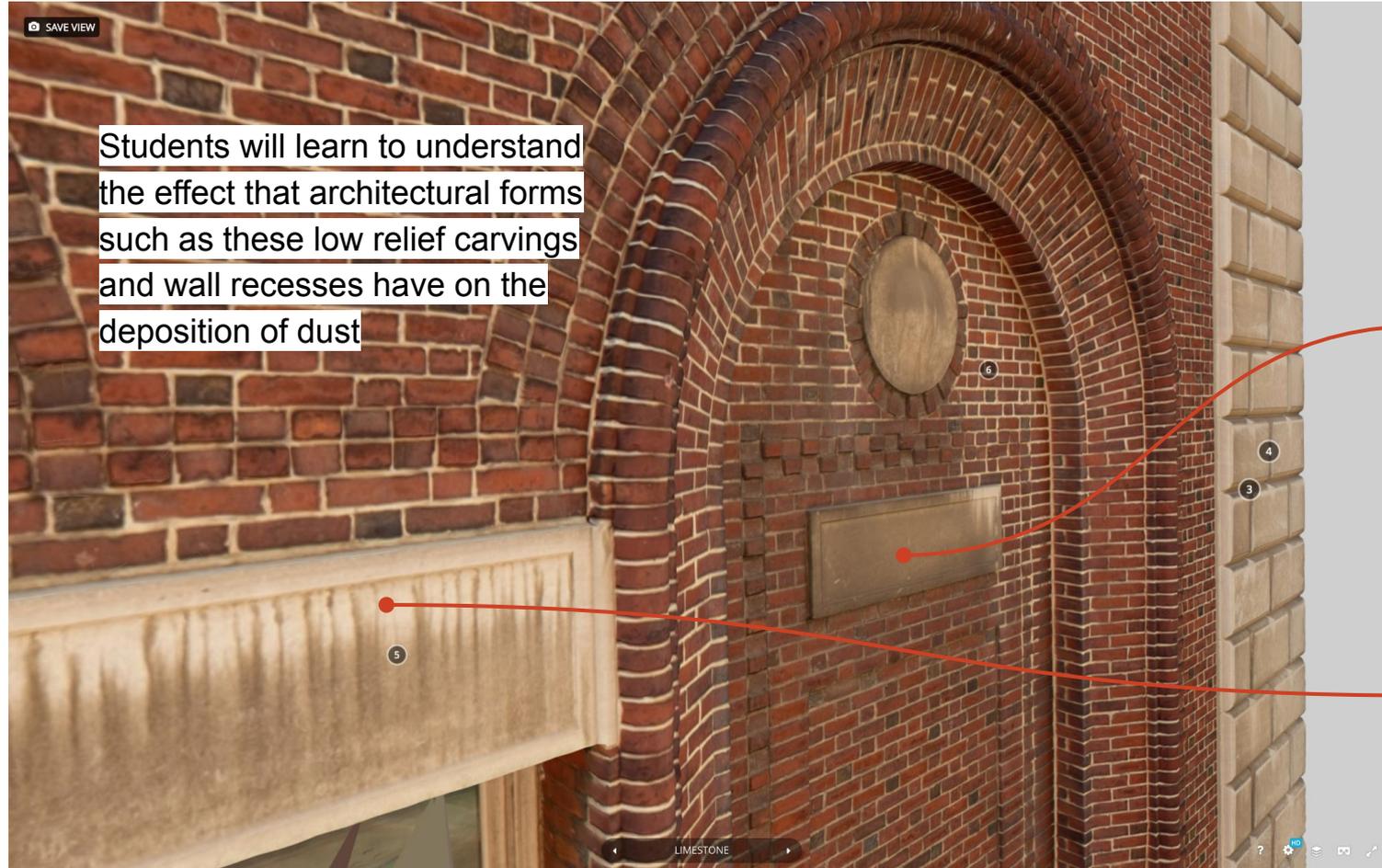


SAVE VIEW

Students will learn to understand the effect that architectural forms such as these low relief carvings and wall recesses have on the deposition of dust

More Stained Limestone in the Recessed Arch

Less Stained Limestone in the Exposed Area

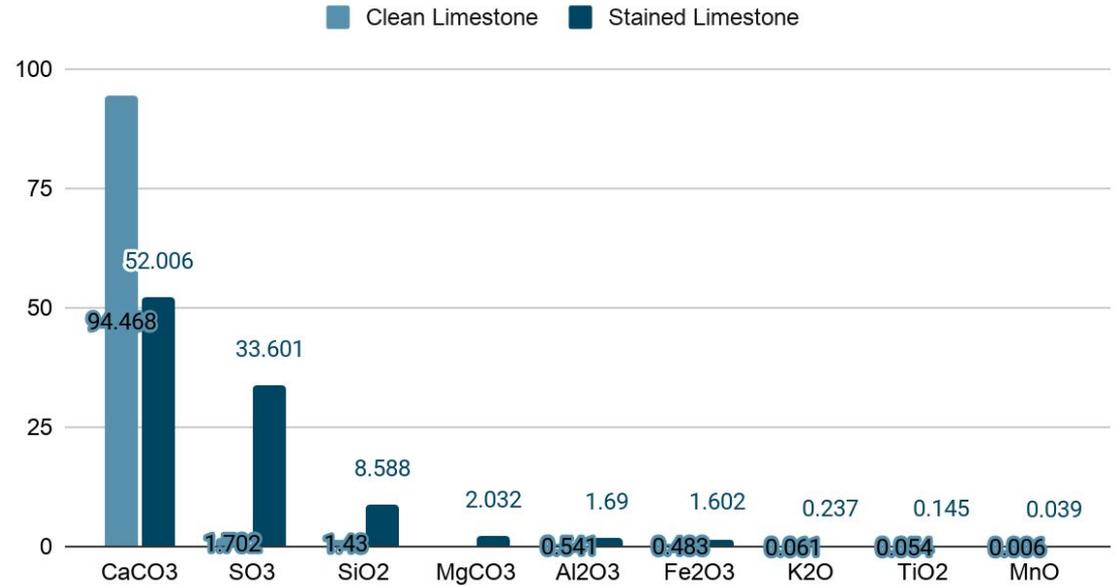


LIMESTONE: Staining Pattern

Students will learn how to use advanced equipment to characterize materials and dusts.

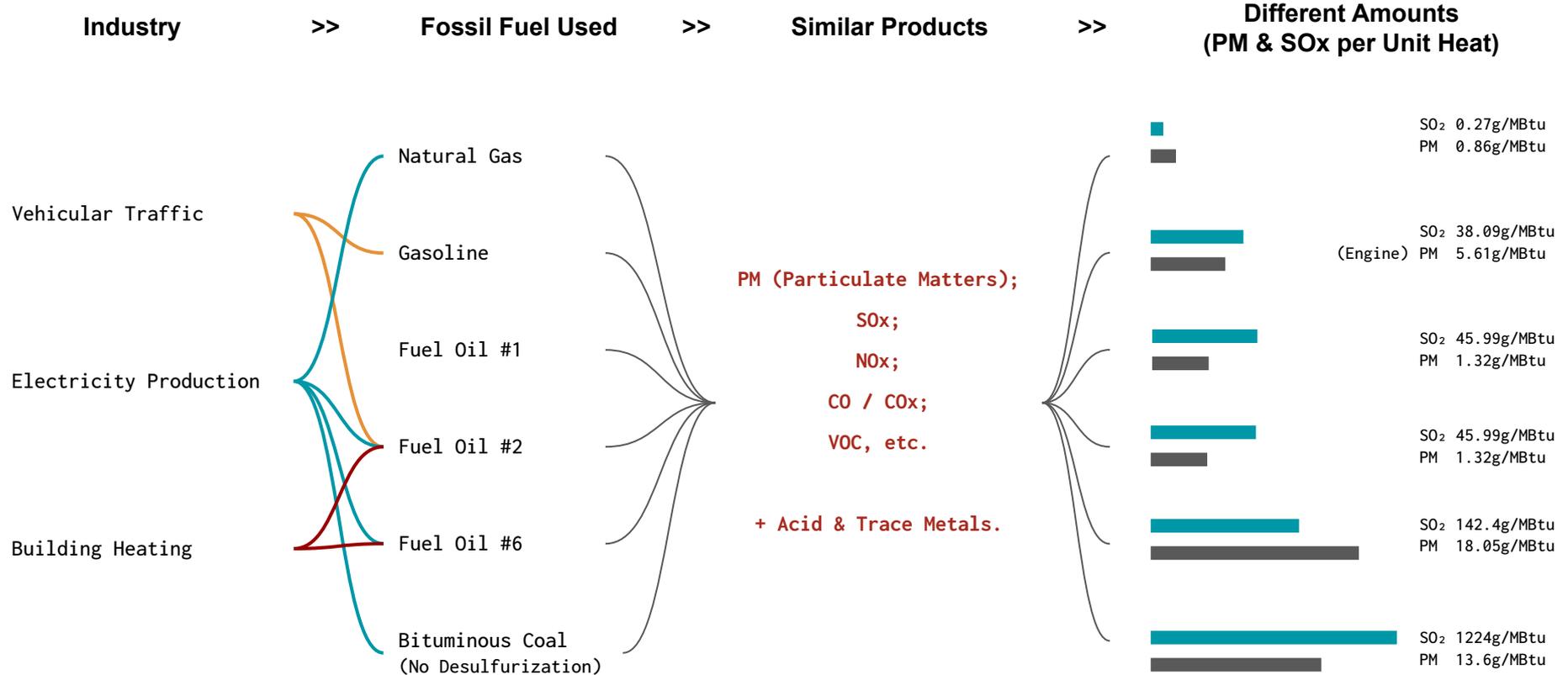


pXRF Reading

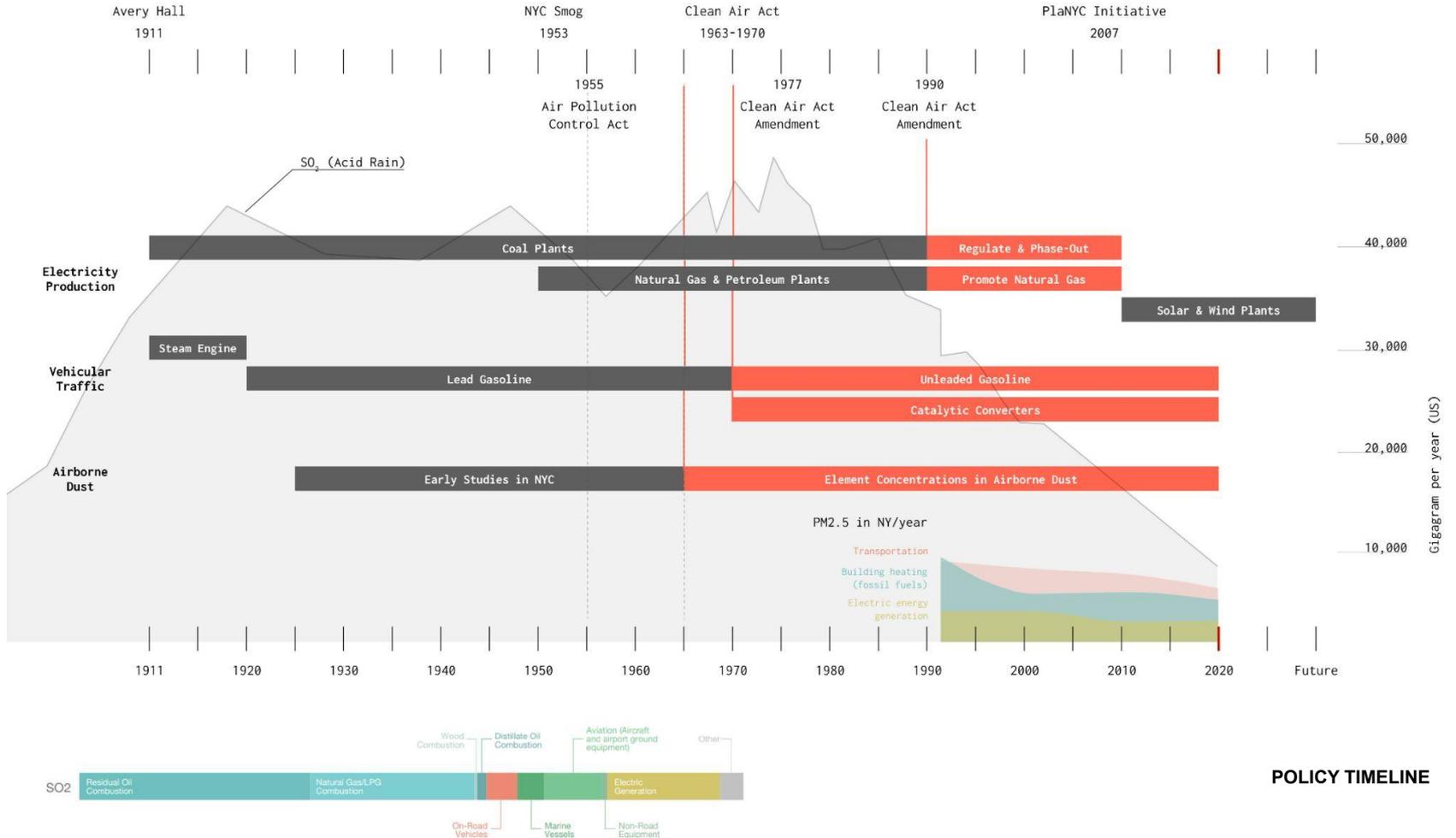


Comparison between Clean and Stained Limestone

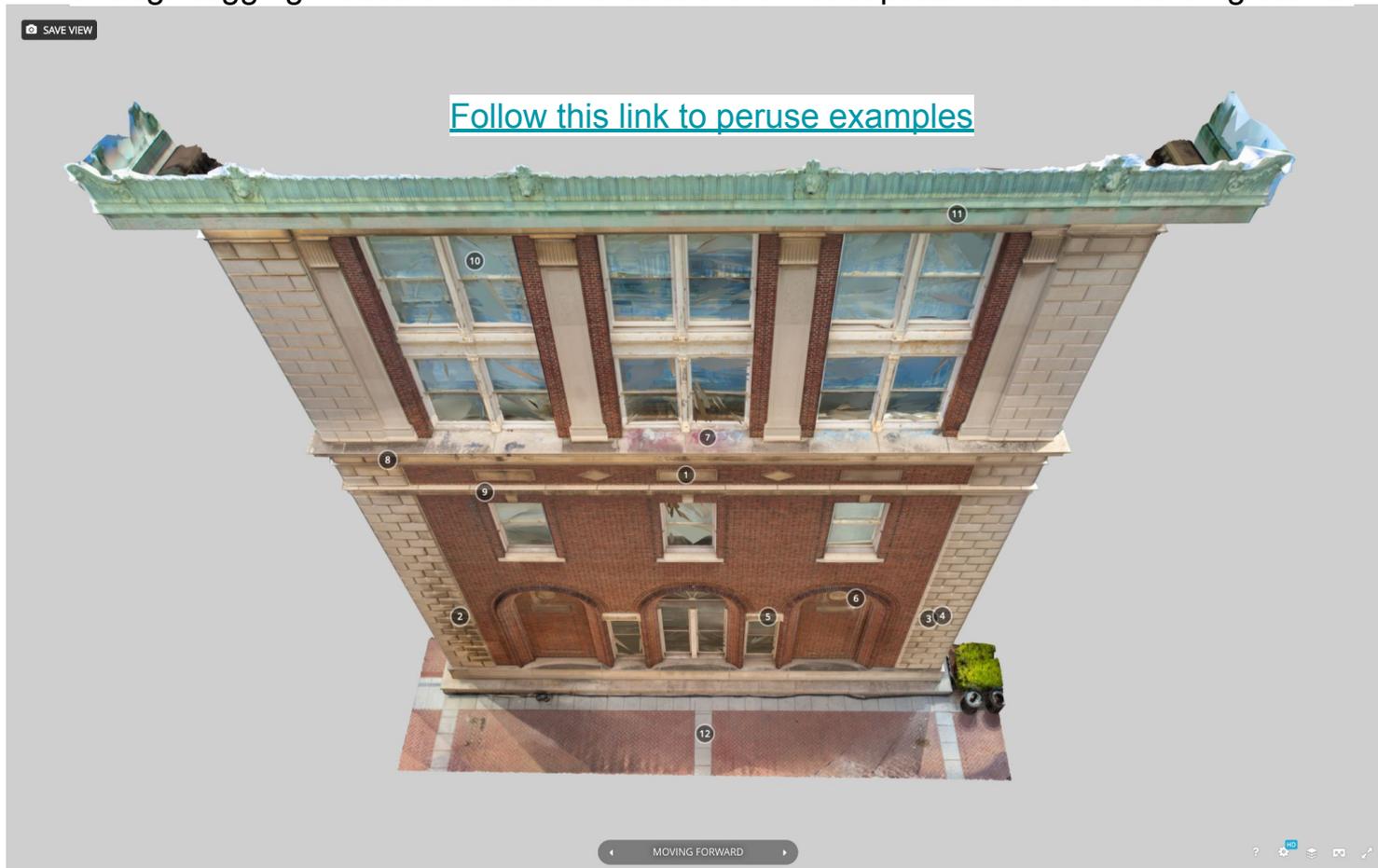
Students will conduct archival research to understand the sources of environmental pollution.



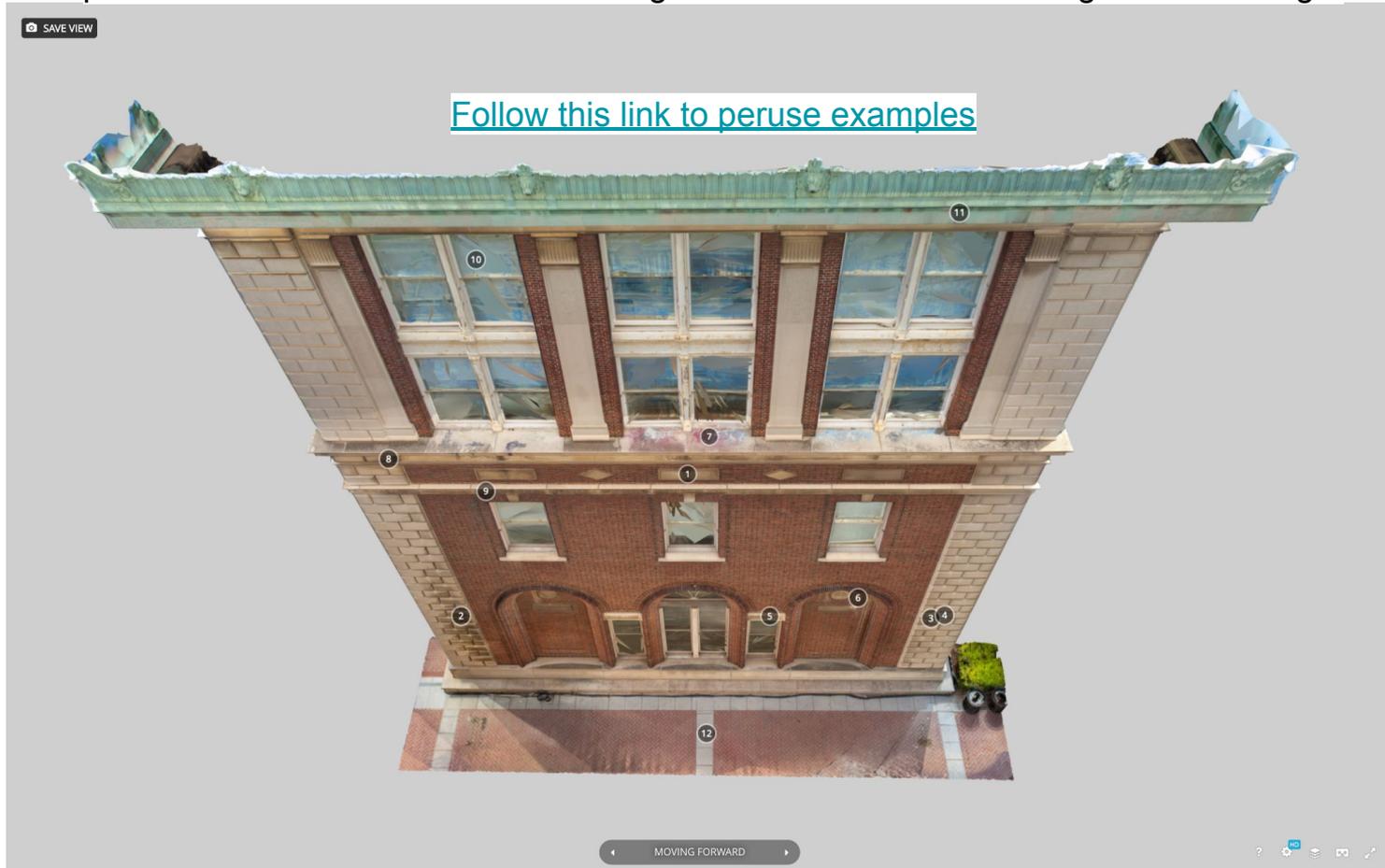
Students will conduct policy analyses to correlate findings on facades with the regulation of key pollutants.



Students will learn digital humanities tools for making their analysis and interpretations available to the public through tagging videos and documents to the 3D dust patterns and 3D building scans.



The workshop will result in interactive 3D scans of buildings that allow the public to visualize the patterns of pollution and understand their meaning and value for understanding climate change.



The workshop will encourage students to reflect on the environmental histories encoded in building facades all over New York City.



The workshop will encourage students to reflect on what is lost when dust layers are destroyed. As in the example below of the Ghostbusters Fire Station in Tribeca.

