



**ANALYZING THE ROOT CAUSES OF CONSTRUCTION DELAYS: A TEXT  
ANALYTICS APPROACH**

Fordham University

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Ge Jin, Jingbo Zhang, Muyue Jin, Ruth Kissel, Tu Ho

## 1. Background and Motivation

The NYC Department of Design and Construction (DDC) is responsible for managing capital construction projects for the city. They build and renovate civic facilities like firehouses, libraries, and police precincts, collaborating with city agencies and architects. DDC also improves infrastructure such as roadways, sewers, and water mains in all five boroughs, contributing to a resilient city.

The motivation behind our analysis stems from the crucial role that construction projects play in developing and maintaining a city's infrastructure. By analyzing construction delays in public buildings and infrastructure projects managed by the NYC DDC, we aim to identify and understand the primary causes of these delays. This information is invaluable for improving project management practices, enhancing efficiency, and ensuring that construction projects are completed on time and cost-effectively. Our analysis and findings serve as a valuable resource for the public construction industry in NYC, providing insights that can lead to better decision-making and more successful project outcomes.

## 2. Strategic Plan

The analysis of the Delay Data was directly influenced by the DDC's strategic plan, which has actively pursued enhancements in reporting measures and data integration in recent years. As articulated in the 2019 Blueprint, "Incorporate Robust Project Controls: The agency will expand the use of extensive data collected on past projects to strengthen, monitor, and continuously improve project cost assessments and standardize schedule durations, project risk management, and agency processes."<sup>1</sup> The Delay Data, a substantial dataset previously unavailable, emerged as a result of the initiatives outlined in the 2019 Blueprint. Our text analytics approach was crafted to digest this dataset, beginning to understand root causes of delay issues. Additionally, the 2022 Blueprint builds upon the 2019 one stating, "Since the 2019 Blueprint, DDC has advanced a rigorous, performance-based approach to agency operations. We have embedded a culture of performance management at all stages of project delivery. Using clear and measurable data alongside ambitious targets, DDC continually monitors performance

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<sup>1</sup>New York City Department of Design and Construction, "2019 Strategic Blueprint Update," accessed May 13, 2024, [https://www.nyc.gov/assets/ddc/images/content/pages/press-releases/2019/2019\\_Strategic\\_Blueprint\\_Update.pdf](https://www.nyc.gov/assets/ddc/images/content/pages/press-releases/2019/2019_Strategic_Blueprint_Update.pdf).

to chart our progress. We also identify opportunities for improvement and devise data-driven strategies to address them.”<sup>2</sup> The sophisticated clustering analysis conducted was possible because of the clear and measurable data set forth by the DDC’s strategic plan, highlighting the DDC’s ongoing efforts to utilize data for informed decision-making.

### **3. Problem Statements**

While the New York City Department of Design and Construction plays a critical role in managing critical infrastructure and public building projects, continued delays pose significant challenges affecting the timely and cost-effective completion of these projects. Construction delays result in increased costs and delay the benefits these projects are designed to provide to the public. Understanding and mitigating these delays is critical to improving project efficiency and effectiveness.

Our study was designed to comprehensively analyze construction delays in public buildings and infrastructure projects managed by the DDC in New York City. Identify the main causes of delays, categorized by project type (public buildings and infrastructure) and construction stage (design, bidding, construction). Evaluate the cluster and project type for these delays.

By addressing these goals, our research aims to contribute to developing targeted strategies that can reduce the incidence of delays and improve the overall project management and execution of construction projects in New York City.

### **4. Dataset Description**

The dataset recorded by NYC DDC contains information about construction delays recorded by the NYC DDC. Each row represents a delay incident and includes details such as the project ID, division, borough, parent project type, project type, delays or gains, delay category, delay subcategory, delay impacted phase, delay description, overall schedule impact in calendar

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<sup>2</sup> New York City Department of Design and Construction, Strategic Blueprint 2022, accessed May 13, 2024, [https://www.nyc.gov/assets/ddc/downloads/publications/Strategic\\_Blueprint\\_2022.pdf](https://www.nyc.gov/assets/ddc/downloads/publications/Strategic_Blueprint_2022.pdf).

construction days (CCDs), delay start date, and delay end date. These delays can occur in various phases of the project and can impact the overall schedule.

It is also necessary to partition these delayed projects into public buildings and infrastructures, as well as further divide them into the three construction phases - design, bid, and build- because this can help analyze the delay factors more effectively. Due to their unique characteristics and requirements, public buildings and infrastructure projects often have different delay factors. Similarly, analyzing delays based on construction phases can provide insights into when and why delays are more likely to occur, allowing for targeted mitigation strategies. This approach can help in identifying patterns and trends specific to each project type and construction phase, leading to more informed decision-making and better project management practices.

## **5. Overview of Subcategory Risk:**

### **1 Scope Management**

- 1.01 Scope Changes

- 1.02 Lack of Definition

- 1.99 Other

### **2 Schedule Management**

- 2.01 Delay by Vendor

- 2.02 Delay by External Stakeholder

- 2.99 Other

### **3 Cost Management**

- 3.01 Funding

- 3.02 Payments

- 3.03 Other

### **4 Quality Management**

- 4.01 Design Error

- 4.02 Design Omission

4.03 Construction Quality

4.04 Schedule Quality

4.05 Estimate Quality

4.99 Other

## 5 Resource Management

5.01 DDC Staff

5.02 Standard Procedures

5.03 Technology

5.99 Other

## 6 Procurement Management

6.01 Contract Terms

6.02 Change Order Management

6.03 Procurement Management

6.04 Property Acquisition

6.99 Other

## 7 Stakeholder Management

7.01 Communication

7.02 Oversight

7.03 Public

7.04 Interface with Other Projects

7.99 Other

## 8 External Environment

8.01 Market Conditions

8.02 Public Health Emergency

8.03 Natural Hazards

8.04 Administrative Change

8.99 Other

## 9 Construction Conditions

9.01 Environmental Conditions

9.02 Private Utilities

9.03 Subsurface Field Conditions

9.04 Above Grade Field Condition

9.05 Health and Safety

9.06 Site Access & Ownership

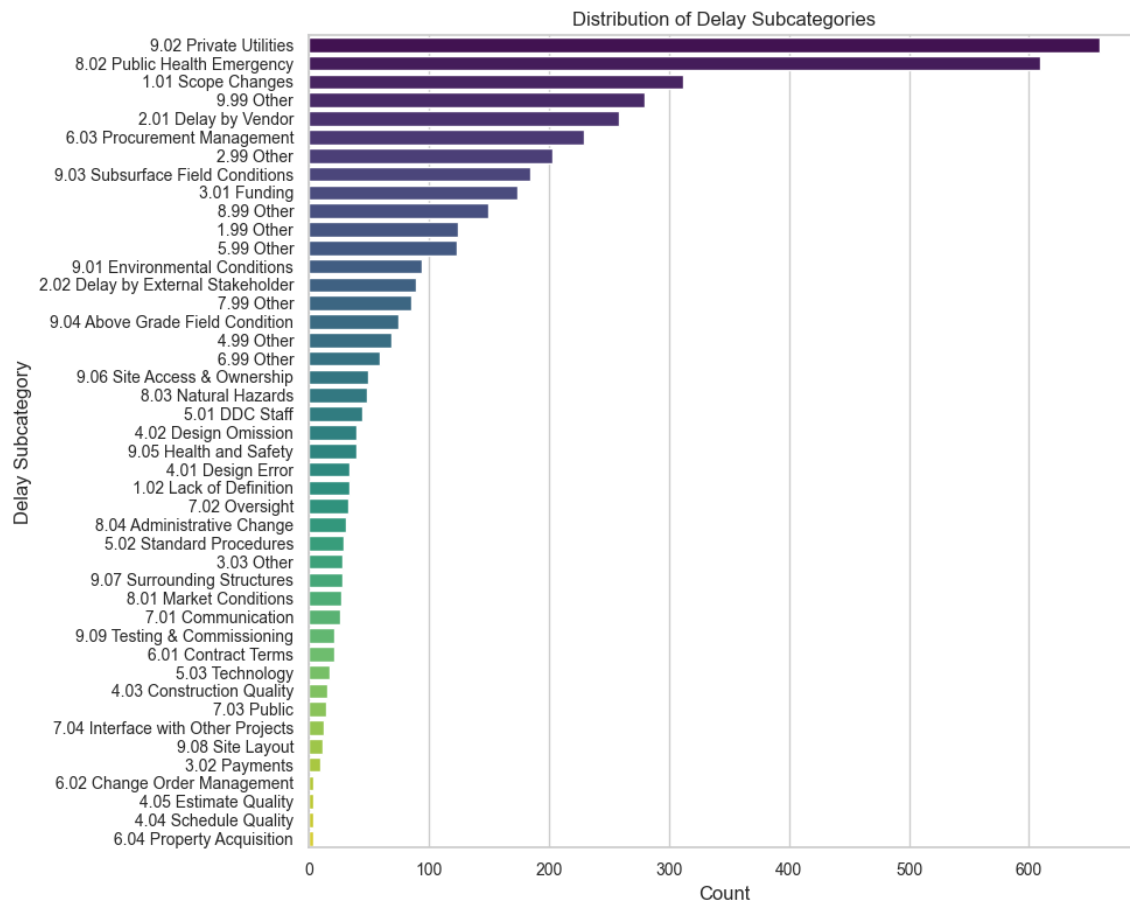
9.07 Surrounding Structures

9.08 Site Layout

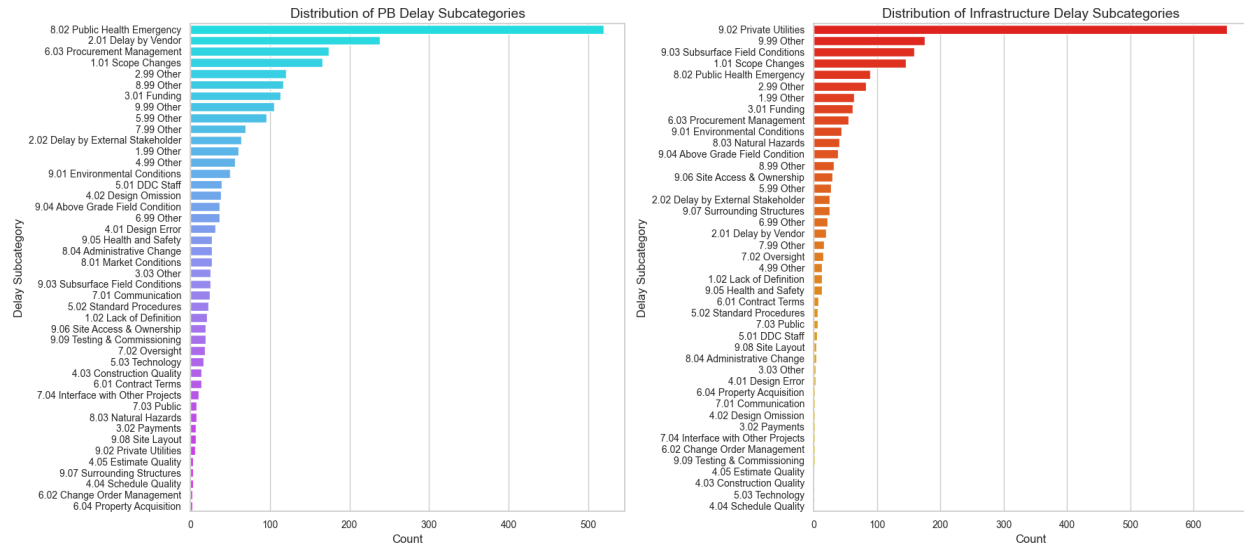
9.09 Testing & Commissioning

9.99 Other

From the "Overall Distribution of Delay Subcategories" chart, it is observable that '9.02 Private Utilities' and '8.02 Public Health Emergency' are the most frequent causes of project delays, highlighting the impact of external environmental factors and unforeseen events on project timelines. Additionally, '2.01 Delay by Vendor' also emerges as a significant factor, pointing out the central role of supply chain management in project management.

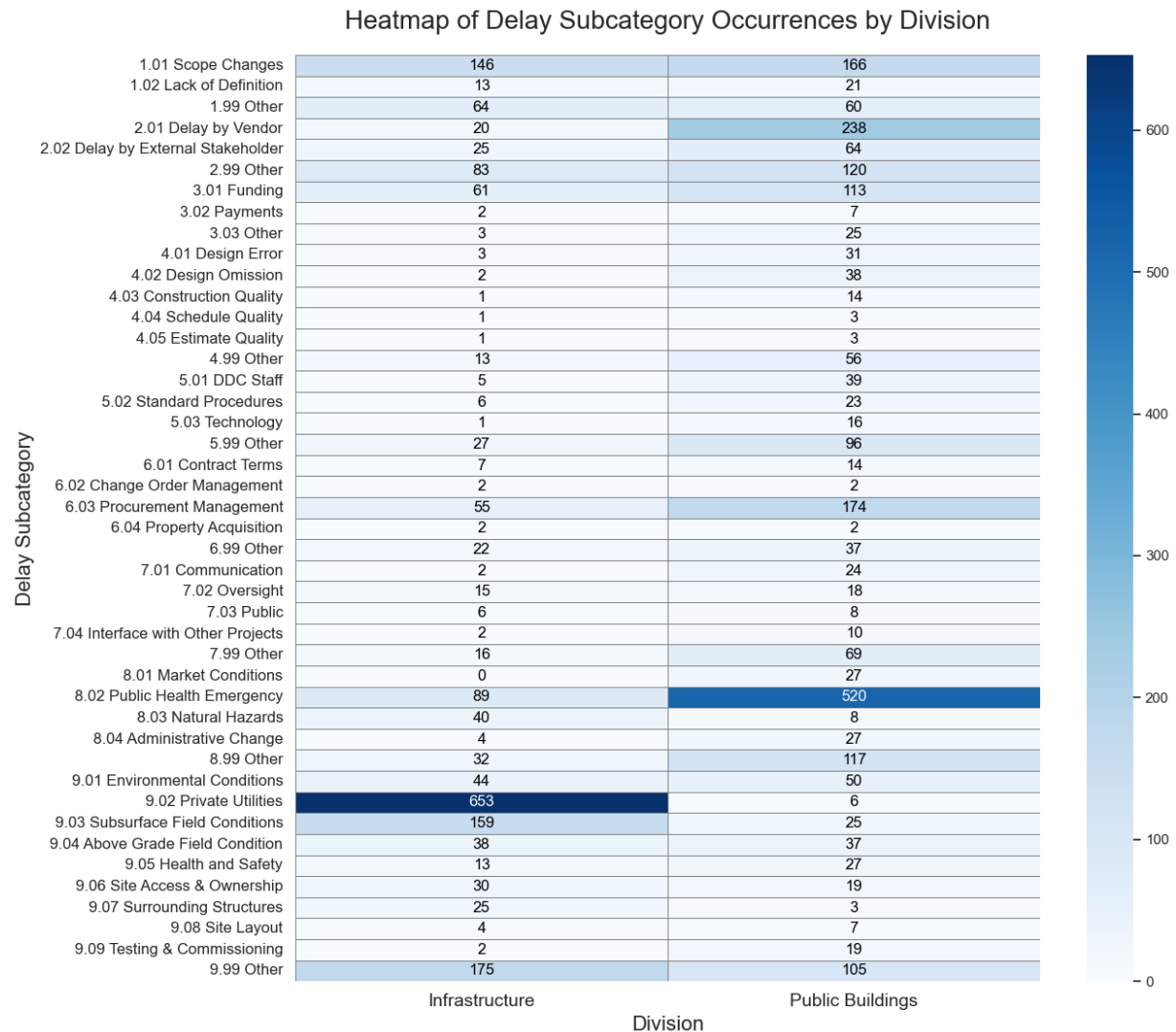


Further examination of the PB Delay Subcategories and Infrastructure Delay Subcategories charts reveals distinct patterns. In Public Building projects, “8.02 Public Health Emergency,” “2.01 Delay by Vendor,” “6.03 Procurement Management,” and “1.01 Scope Changes” are more common. In contrast, in Infrastructure projects, the impacts of “9.02 Private Utilities,” “9.03 Subsurface Field Condition,” “1.01 Scope Changes,” and “Public Health Emergency” are more pronounced. These differences suggest that different project types may require tailored strategies and measures in their management and execution.



Lastly, the Heatmap of Delay Subcategory Occurrences by Division provides a visual data analysis that displays the frequency of various delay subcategories across different divisions. This visualization allows managers to quickly identify the primary causes of delays within specific departments and formulate targeted improvement measures accordingly.





## 6. Methodology

### 6.1 Analytical Methods

#### 6.1.1 Bag-of-Words

The Bag-of-Words model is a text representation method used to preprocess text into numeric vectors by counting the frequency of each word in the document. Bag-of-Words can account for a single word and a collection of phrases, including two words (2-grams), three words (3-grams), and so on. For this project, 3-grams and 4-grams have been used to provide broader insights into the causes of delay and to reduce redundancy as the size of n-grams

increases. In order to account for the anomaly that was Covid-19, we removed all keywords that were related to Covid-19 pandemic.

### **6.1.2 Part-of-speech**

Part-of-speech tagging (POS), or grammatical tagging, labels each word in a text based on its syntactic context and role. Usually, words can fall into one of the following major grammar categories: Noun, Verb, Adjective, and Adverb. This method helps in understanding the grammatical structure and meaning of sentences. In this analysis, the POS approach extracts the top 30 trigrams and 4-gram words with the highest frequency, excluding adverb words. However, after conducting POS tagging we found it did not offer any new insights after the Bag-of-Words approach.

#### **POS Dictionary:**

- NN: Noun (singular or mass)
- NNS: Noun (plural)
- NNP: Proper noun (singular)
- NNPS: Proper noun (plural)
- VB: Verb (base form)
- VBD: Verb (past tense)
- VBG: Verb (gerund/present participle)
- VBN: Verb (past participle)
- VBP: Verb (non-3rd person singular present)
- VBZ: Verb (3rd person singular present)
- JJ: Adjective
- JJR: Adjective (comparative)
- JJS: Adjective (superlative)

### 6.1.3 Clustering

In this project, we carried out text cleaning, standardization, and morphology reduction of the “Delay Description” column in the delayed data to prepare the data for further text analysis. Firstly, a bag of words model (BOW) is used to preprocess the text data, generating 3-gram and 4-gram data sets. For better data consolidation, we chose datasets with more risk subcategories. Determining to use a 3-gram or 4-gram dataset, we traced each phrase back to a specific project ID and created a new dataset. In this dataset, if an item contains a risk subcategory, its total is marked in the column for that risk subcategory; If it does not, it is marked as 0. Then, the K-means clustering method is used to analyze the risk subcategory data. Finally, we use Tableau software to visualize the clustering results and show each project’s distribution of risk subcategories. This approach enables us to effectively identify and analyze potential risks in the project, providing data support for further risk management and decision-making.

## 7. Analysis of Keyword Frequency

### 7.1 Bag-of-Words Approach

#### Top 30 3-gram Frequency

Phase	Public Building	Infrastructure
<b>Design</b> (Design and Initiation)	<ul style="list-style-type: none"><li>• phase admin building, <a href="#">add in design requested by DOT</a></li><li>• lno required fdny, <a href="#">Liasion Officers required Fire Department NY, related to fire prevention and safety services</a></li><li>• amended design initial</li><li>• bid packaging review</li><li>• updated lno required, <a href="#">updated lno required for fire safety was delayed</a></li><li>• design initial construction</li><li>• initial construction cp, <a href="#">related to rejection of certified to proceed request</a></li><li>• project hold due</li><li>• procurement jocs mwbe, <a href="#">changed from JOC to meet requirements in MWBE (minority/women-owned</a></li></ul>	<ul style="list-style-type: none"><li>• project move fy <a href="#">this project moved to another fiscal year</a></li><li>• legacy project pre <a href="#">Legacy project / Pre - FEP. Project start date input was draft CPI received date.</a></li><li>• project pre fep</li><li>• pre fep project</li><li>• fep project start</li><li>• project start date</li><li>• start date input</li><li>• date input draft</li><li>• input draft cpi</li><li>• draft cpi receive</li><li>• cpi receive date</li></ul>

	<p>business enterprises) in bid phase caused the delay</p> <ul style="list-style-type: none"> <li>• amended design cp</li> <li>• new consultant team</li> <li>• revised reflect delay</li> <li>• schedule revised reflect</li> <li>• reflect delay caused</li> <li>• bid package intake</li> <li>• sponsor agency requested</li> <li>• sponsor agency delayed</li> <li>• agency delayed provide</li> <li>• provide updated lno, related to fire prevention and fire safety requirements above</li> <li>• delayed provide updated</li> <li>• building roof replacement, related to phase admin building above</li> <li>• work phase admin, related to phase admin building above</li> <li>• revise procurement jocs</li> <li>• fdny approval coordination, related to FDNY approval above</li> <li>• design procurement team</li> <li>• submitted ddc review</li> </ul>	<ul style="list-style-type: none"> <li>• design completion date moved to another date</li> <li>• design task order Delay in this progress</li> <li>• project roll fy to another fiscal year</li> <li>• dep revise contract department of environmental protection</li> <li>• revise contract language</li> <li>• fy sponsor agency Sponsor agency moved to fiscal year 24/25</li> <li>• actual design completion Competition date is different due to rebid</li> <li>• design service suspend by NYC DOT</li> <li>• move project fy To another fiscal year</li> <li>• move fy fy</li> <li>• e nd st closure of E. 92nd St entrance ramp was found by NYC DOT to be impractical</li> <li>• roll fy sponsor</li> <li>• fy approve april original approved in April FY2022, moved to other Fiscal year</li> <li>• approve april plan</li> <li>• funding move fy Funding moved to another fiscal year</li> <li>• april plan project</li> <li>• acquisition process project property acquisition process</li> <li>• put project onhold</li> <li>• dep request add additional language</li> </ul>
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		and one unit item to the emergency contracts
<b>Bid</b> (Construction Procurement)	<ul style="list-style-type: none"> <li>• site safety plan more straightforward, safety of site wasn't in check at first</li> <li>• abated architectural drawing interesting, cause of delay was architecture changes?</li> <li>• bpl lighting consultant bpl?</li> <li>• sub responding consultant</li> <li>• spot abatement abatement</li> <li>• sponsor delay securing</li> <li>• resubmitted budget cp delay due to waiting on certificate to proceed, additional cp related delays below</li> <li>• resubmit bid package can potentially cause major delays if the bid package needs to be submitted several times</li> <li>• responding consultant request</li> <li>• requested cp see above breakdown postponed time acco</li> <li>• opening postponed time</li> <li>• open bid bid</li> <li>• omb reviewed ewa see below 2, potential delay with office of management and budget?</li> <li>• omb review approval</li> <li>• omb requested cp see above re cp</li> <li>• issue associated pql</li> <li>• institution ddc manage</li> <li>• cp sent omb see above</li> <li>• call entire basement</li> <li>• budget cp sent issues with the budget?</li> <li>• brought light walkthrough</li> <li>• breakdown requested contractor</li> <li>• breakdown area cp see above re cp</li> <li>• breakdown area consultant</li> <li>• sub took long a straightforward delay, someone or something took longer</li> </ul>	<ul style="list-style-type: none"> <li>• project move fy to fiscal year 2024</li> <li>• procurement delay due new system passport</li> <li>• delay due new</li> <li>• due new system</li> <li>• new system passport</li> <li>• bid open date the bid open date is delayed</li> <li>• contract register ntp Notice to Proceed</li> <li>• register ntp issue</li> <li>• cp approval omb Office of Management and Budget approved in another fiscal year</li> <li>• rei procurement delay</li> <li>• cp approval delay</li> <li>• cp submit omb Dut to waiting approval by office of management and budget</li> <li>• move bid date</li> <li>• amend design cp</li> <li>• rei task order</li> <li>• eo due diligence EO102- due diligence memo</li> <li>• due diligence memo</li> <li>• bid opening postpone</li> <li>• opening postpone due</li> <li>• postpone due omb Office of Management and Budget</li> <li>• due omb pause Office of Management and Budget</li> <li>• omb pause outbreak</li> <li>• revision buffer surface Revisions to the buffer surface grade as</li> </ul>

		<p>requested by DDC Public Buildings.</p> <ul style="list-style-type: none"> <li>• buffer surface grade</li> <li>• surface grade request</li> <li>• grade request ddc</li> <li>• request ddc public</li> <li>• ddc public building</li> <li>• bid open move</li> <li>• open move due</li> </ul>
<p><b>Build</b> (Construction and Closeout)</p>	<ul style="list-style-type: none"> <li>• time extension approval</li> <li>• approved time extension</li> <li>• approved delay associated</li> <li>• fire alarm device Wireless fire alarm devices are missing. Contractor is not sure when they will be delivered.</li> <li>• deteriorated collapsed sewer Dorm 1- Excavate to expose existing deteriorated and collapsed sewer mains. This additional work was needed to complete the original scope.</li> <li>• courtroom lobby affect Court did not decide if the will install fire alarm devices on courtroom and lobby which will affect the contractor planning for work.</li> <li>• install fire alarm</li> <li>• device courtroom lobby</li> <li>• contractor planning work Court did not decide if they will install fire alarm devices on courtroom and lobby which will affect the contractor planning for work.</li> <li>• fire alarm system Pending FDNY inspection date of the newly installed fire alarm system.</li> <li>• decide install fire</li> <li>• alarm device courtroom</li> <li>• affect contractor planning</li> <li>• part approved time</li> <li>• court decide install</li> </ul>	<ul style="list-style-type: none"> <li>• facility direct interference</li> <li>• con edison electric</li> <li>• direct interference propose</li> <li>• con edison gas</li> <li>• new gas main Replace new gas main</li> <li>• contractor stop work</li> <li>• trunk water main</li> <li>• con edison facility Con edison Relocation</li> <li>• stop work due</li> <li>• interference propose city</li> <li>• contractor hand dig</li> <li>• con edison electrical</li> <li>• due gas cross</li> <li>• work due hpd Due HPD funding shortage</li> <li>• due phd funding</li> <li>• hpd funding shortage</li> <li>• edison electric facility</li> <li>• religious holiday per</li> <li>• national grid interference</li> <li>• gas cross electrical</li> <li>• cross electrical duct</li> <li>• contractor schedule support</li> <li>• water main installation</li> <li>• gas main installation</li> <li>• due inclement weather</li> <li>• electric facility direct</li> </ul>

	<ul style="list-style-type: none"> <li>• delay associated work</li> <li>• lobby affect contractor</li> <li>• construction start date <a href="#">rescheduled</a></li> <li>• item part approved</li> <li>• work included item</li> <li>• associated work included</li> <li>• included item part</li> <li>• supply chain issue</li> <li>• site safety plan <a href="#">needs revision or not submitted</a></li> <li>• shaft work ccds</li> <li>• partial stop work <a href="#">A partial stop work order was issued by DDC Safety. Contractor must submit SSP and JHA.</a></li> <li>• fuel oil tank <a href="#">This leak prevented us from waterproofing the existing slab of the fuel oil tank room. The approved delays associated with this item are included in the approved Time Extension #1 approval.</a></li> <li>• work ccds lpc <a href="#">Shaft A work – 22% - 22.00 ccds. LPC Approved changes – space designs reconfiguration. 55% 55.00 ccds.</a></li> <li>• wireless fire alarm <a href="#">PAA for the wireless fire alarm drawings is not approved by FDNY yet.</a></li> <li>• space design reconfiguration</li> </ul>	<ul style="list-style-type: none"> <li>• contractor decide work <a href="#">contractor decided not to work</a></li> <li>• excavation safety alert</li> <li>• ave due gas <a href="#">41st to 44th Street b/n 1 Ave to 4 Ave due to gas crossing and electrical ducts.</a></li> <li>• stop work order</li> </ul>
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### Top 30 4-gram Frequency

The extension to 4-gram frequency reduces duplication and related terms. For example, during the design phase, the 4-gram approach combines the trigram keywords ('initial construction cp' and 'design initial construction') into the complete phrase 'design initial construction cp.' Similarly, 'phase admin building' and 'work phase admin' are combined into 'work phase admin building'. This extension effectively eliminates redundant terms and enhances the specificity of keyword analysis.

Phase	Public Building	Infrastructure
<b>Design</b> (Design and Initiation)	<ul style="list-style-type: none"> <li>• amended design initial construction</li> <li>• updated lno required fdny</li> <li>• design initial construction cp, <a href="#">refer to delayed in approval of design initial construction cp request</a></li> <li>• revised reflect delay caused</li> <li>• schedule revised reflect delay</li> <li>• sponsor agency delayed provide</li> <li>• delayed provide updated lno</li> <li>• agency delayed provide updated</li> <li>• work phase admin building, <a href="#">related to add in design requested by DOT</a></li> <li>• provide updated lno required</li> <li>• ddc design procurement team</li> <li>• staff shortage finance procurement</li> <li>• revise procurement jocs mwbe, <a href="#">related to updated requirement to meet MWBE</a></li> <li>• submitted ddc review due</li> <li>• finance procurement unit unable</li> <li>• ddc review due staff</li> <li>• approval coordination sponsor dhs</li> <li>• cp submitted ddc review</li> <li>• procurement unit unable review</li> <li>• review due staff shortage</li> <li>• fdny approval coordination sponsor</li> <li>• shortage finance procurement unit</li> <li>• due staff shortage finance</li> <li>• dd submission found unsatisfactory</li> <li>• completion cd document submission</li> <li>• lno required fdny filling</li> </ul>	<ul style="list-style-type: none"> <li>• legacy project pre fep <a href="#">Legacy project / Pre -FEP. Project start date input was draft CPI received date.</a></li> <li>• project pre fep project</li> <li>• pre fep project start</li> <li>• fep project start date</li> <li>• project start date input</li> <li>• start date input draft</li> <li>• date input draft cpi</li> <li>• input draft cpi receive</li> <li>• draft cpi receive date</li> <li>• dep revise contract language</li> <li>• project roll fy sponsor <a href="#">Sponsor agency moved to fiscal year 24/25</a></li> <li>• roll fy sponsor agency</li> <li>• fy approve april plan</li> <li>• project move fy fy</li> <li>• actual design completion date</li> <li>• problem new system passport</li> <li>• scope change bioswales porous <a href="#">Scope change from Bioswales to Porous pavement generated the need for complete design change.</a></li> <li>• change bioswales porous pavement</li> <li>• bioswales porous pavement generate</li> <li>• porous pavement generate need</li> <li>• pavement generate need complete</li> <li>• generate need complete design</li> <li>• need complete design change</li> </ul>



	<ul style="list-style-type: none"> <li>external factor relating public</li> <li>delay attributed consultant submitting</li> <li>reflect delay caused external</li> <li>unsatisfactory pushed back schedule, <a href="#">refer to Obra's D and DD submission</a></li> </ul>	<ul style="list-style-type: none"> <li>design task order procurement</li> <li>post construction storm water <a href="#">the project now requires post construction storm water management</a></li> <li>construction storm water management</li> <li>storm water management practice</li> <li>project design completion date</li> <li>design completion delay due</li> <li>due property acquisition process</li> </ul>
<b>Bid</b> (Construction Procurement)	<ul style="list-style-type: none"> <li>abated architectural drawing ceiling <a href="#">lots of keywords related to ceiling, see 4 below</a></li> <li>basement ceiling abated architectural</li> <li>ceiling abated architectural drawing</li> <li>ceiling abatement consultant revise</li> <li>ceiling include spot abatement</li> <li>happened fcb review awarded <a href="#">fcb acronym?</a></li> <li>changed open bid bid <a href="#">changes cause delays</a></li> <li>client institution ddc manage</li> <li>code drawing delaying consultant <a href="#">straightforward delay with work taking longer</a></li> <li>sent omb cp returned <a href="#">see above, cp issue</a></li> <li>securing additional funding needed <a href="#">additional funding needed to proceed</a></li> <li>package revision consultant needed <a href="#">see below re consultant</a></li> <li>funding needed registration supplemental</li> </ul>	<ul style="list-style-type: none"> <li>procurement delay due new <a href="#">Rei procurement delay due to new system passport</a></li> <li>delay due new system</li> <li>due new system passport</li> <li>contract register ntp issue <a href="#">Notice to Proceed</a></li> <li>rei procurement delay due</li> <li>eo due diligence memo <a href="#">EO-102 due diligence memo</a></li> <li>bid opening postpone due <a href="#">by omb Office of Management and Budget pause</a></li> <li>opening postpone due omb</li> <li>postpone due omb pause</li> <li>due omb pause outbreak</li> <li>revision buffer surface grade</li> <li>buffer surface grade request <a href="#">Revisions to the buffer surface grade as requested by DDC Public Buildings.</a></li> <li>surface grade request ddc</li> <li>grade request ddc public</li> <li>request ddc public building</li> <li>bid open move due</li> </ul>

	<ul style="list-style-type: none"> <li>• packaging unit caught legal legal issues?</li> <li>• forgot two rfis latest</li> <li>• consultant dga included electrical</li> <li>• consultant needed time revision see below, delays caused by additional time/work needed by consultant</li> <li>• consultant request update ada</li> <li>• consultant revise basement ceiling</li> <li>• consultant sub took long</li> <li>• consultant submitting bid set</li> <li>• consultant working area breakdown</li> <li>• rfis forgot two rfis</li> <li>• revision consultant needed time</li> <li>• revise basement ceiling include see above ceiling keywords</li> <li>• hold dcla private design dcla?</li> <li>• hold due cp omb</li> <li>• opening postponed time acco is acco an acronym?</li> <li>• omb requested cp breakdown see above, cp related issue</li> <li>• bid drawing bid packaging</li> </ul>	<ul style="list-style-type: none"> <li>• open move due original Bid Opening was moved to due the original Bid Opening date being after a major holiday at the request of potential bidders.</li> <li>• move due original bid</li> <li>• due original bid open</li> <li>• original bid open date</li> <li>• bid open date major</li> <li>• open date major holiday</li> <li>• date major holiday request</li> <li>• major holiday request potential</li> <li>• holiday request potential bidder</li> <li>• bid open date postpone The Bid Opening date had to be postponed due to an MWBE issue.</li> <li>• open date postpone due</li> <li>• date postpone due mwbe</li> <li>• postpone due mwbe issue</li> <li>• revise ntp issue utility</li> </ul>
<b>Build</b> (Construction and Closeout)	<ul style="list-style-type: none"> <li>• approved time extension approval</li> <li>• part approved time extension</li> <li>• affect contractor planning work Court did not decide if the will install fire alarm devices on courtroom and lobby which will affect the contractor planning for work.</li> <li>• courtroom lobby affect contractor</li> <li>• fire alarm device courtroom Court did not decide if they will install fire alarm devices</li> </ul>	<ul style="list-style-type: none"> <li>• facility direct interference propose</li> <li>• contractor stop work due Due hpd funding shortage</li> <li>• direct interference propose city</li> <li>• stop work due hpd</li> <li>• work due hpd funding</li> <li>• due hpd funding shortage</li> <li>• con Edison electric facility</li> <li>• due gas cross electrical gas crossing and electrical ducts</li> <li>• gas cross electrical duct</li> <li>• con Edison facility direct</li> </ul>

	<p>on courtroom and lobby which will affect the contractor planning for work.</p> <ul style="list-style-type: none"> <li>• device courtroom lobby affect</li> <li>• alarm device courtroom lobby</li> <li>• approved delay associated work</li> <li>• court decide install fire</li> <li>• install fire alarm device</li> <li>• decide install fire alarm</li> <li>• lobby affect contractor planning</li> <li>• delay associated work included</li> <li>• associated work included item</li> <li>• included item part approved</li> <li>• work included item part</li> <li>• item part approved time</li> <li>• shaft work ccds lpc</li> </ul> <p>Shaft A work – 22% - 22.00 ccds. LPC Approved changes – space designs reconfiguration. 55% 55.00 ccds.</p> <ul style="list-style-type: none"> <li>• existing deteriorated collapsed sewer</li> <li>• space design reconfiguration ccds</li> <li>• change space design reconfiguration</li> <li>• approved change space design</li> <li>• fund ca phase loring</li> </ul> <p>Now their contract with LiRo has ended for CD phase and they are requesting additional funds for CA phase.</p> <ul style="list-style-type: none"> <li>• work ccds lpc approved</li> <li>• ccds lpc approved change</li> <li>• submission rejected nd submission</li> <li>• st submission rejected nd</li> <li>• expose existing deteriorated collapsed</li> </ul> <p>Dorm 1- Excavate to expose existing deteriorated and collapsed sewer mains. This</p>	<ul style="list-style-type: none"> <li>• ave due gas cross</li> <li>• edison facility direct interference</li> <li>• gas main currently direct</li> </ul> <p>The gas mains are currently in direct interference with the new sewer layout.</p> <ul style="list-style-type: none"> <li>• catch basin chute connection</li> <li>• electric facility direct interference</li> <li>• new gas main installation</li> <li>• con Edison utility interference</li> <li>• interference propose city dwm</li> </ul> <p>Con Edison Electric and Gas facilities in direct interference with proposed City 12-in DWM</p> <ul style="list-style-type: none"> <li>• edison electric facility direct</li> <li>• con Edison ddc issue</li> </ul> <p>Con Edison and DDC has issued excavation safety alert</p> <ul style="list-style-type: none"> <li>• edison ddc issue excavation</li> <li>• ddc issue excavation safety</li> <li>• issue excavation safety alert</li> <li>• notice condition cause delay</li> <li>• contractor schedule support con</li> </ul> <p>The contractor was scheduled to support ConEdison other services</p> <ul style="list-style-type: none"> <li>• schedule support con edison</li> <li>• work perform outside section</li> <li>• perform outside section U</li> <li>• religious holiday per councilman</li> </ul> <p>Religious Holiday - As per Councilman Deutsch Request</p> <ul style="list-style-type: none"> <li>• holiday per councilman deutsch</li> </ul>
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	<p>additional work was needed to complete the original scope.</p> <ul style="list-style-type: none"> <li>• lpc approved change space</li> <li>• deteriorated collapsed sewer main</li> </ul>	
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### **Key Findings:**

- Some keywords may be referencing acronyms so need to clarify those to further dig into these keywords as well.
- Delays can also be related to more straightforward reasons, as some roadmapped tasks can take longer than initially anticipated.
- Delay causes also vary by each division during each phase.

### **Public Building Division:**

- Design phase:
  - In design phase, delays are mainly due to delay in approval requests including add-in to design phase requested by DOT, delayed in FDNY approval, bid packaging review, rejection of certified to proceed request, change and update rule requirement (MWBE).
- Bid phase:
  - A lot of the delays in the “Bid” phase for Public Buildings are related to the Certificate to Process. Is this a residual effect from issues with the CP during the “Design” phase?
  - A lot of the delays in the “Bid” phase for Public Buildings seem to be attributed to consultants either requesting additional information or needing to complete additional work.
- Build phase:
  - A lot of delays are approved through time extension requests.
  - From many projects, it can be found that the installation, absence, or inspection of fire alarm systems has a significant impact on work schedule.

### **Infrastructure Division:**

- Design phase:

- A lot of delays seem to be related to the project being transferred to another fiscal year.
  - Many delays require waiting for the receipt of the draft CPI before they can begin.
- Bid phase:
  - A lot of delays seem to be related to the project being transferred to another fiscal year.
  - Many delays might be caused by technical issues with the new PASSport Procurement System.
- Build phase:
  - There are numerous infrastructure delays in Con Edison, which indicates that energy-related projects may often experience construction delays.
  - A lot of delays seem to be related to some direct interference to the construction.
  - Many contractors stop working due to various funding shortages.

#### **Key Differences:**

- Design phase:
  - The main cause of delay in public buildings related to fire prevention and fire safety (FDNY) approval, design initial cp request and sponsor agency delay. Procurement. Problems in procurement are more likely to occur in public building division, such as staff shortage in DDC procurement team and revise procurement from jocs to mwbe.
  - On the other hand, delays in infrastructure are mainly due to front end planning, sponsor agency and scope change from Bioswales to Porous pavement.
- Bid phase:
  - Public Buildings has more delays related to the Certificates to Proceed and consultants than Infrastructure.
- Build phase:
  - Comparing the two divisions, delays in Public Buildings are more related to some necessary facilities such as fire alarm systems, which aligns with the construction process of public buildings, while those in Infrastructure are more related to some unavoidable interference because many of them are energy-related.

### Key Similarities:

- Design phase:
  - Both Public Buildings and Infrastructure face delays due to design add-in requests and policy/requirements revision and update.
- Bid phase:
  - OMB (Office of Management and Budget) appear in several keywords
  - CP is mentioned a few times in Infrastructure, but appears more frequently in Public Buildings.
- Build phase:
  - Both Public Buildings and Infrastructure have delays caused by the schedule of contractors being affected.

## 7.2 POS

### Top 30 3-grams Frequency:

Phase	Public Building	Infrastructure
<b>Design</b> (Design and Initiation)	Phase Admin Building <ul style="list-style-type: none"><li>• Phase (NNP): noun</li><li>• Admin (NNP): noun</li><li>• Building (NNP): noun</li></ul> LNO required FDNY <ul style="list-style-type: none"><li>• LNO (NNP): noun</li><li>• required (VBD): verb</li><li>• FDNY (NNP): noun</li></ul> Schedule revised reflect <ul style="list-style-type: none"><li>• schedule (NN): noun</li><li>• revised (VBD): verb</li><li>• reflect (JJ): other</li></ul> Revised reflect delay <ul style="list-style-type: none"><li>• revised (VBD): verb</li><li>• reflect (JJ): other</li><li>• delay (NN): noun</li></ul> Reflect delay caused <ul style="list-style-type: none"><li>• reflect (JJ): other</li><li>• delay (NN): noun</li><li>• caused (VBD): verb</li></ul> Updated LNO required	project move fy <ul style="list-style-type: none"><li>• Project(NN): noun</li><li>• move(VBD): verb</li><li>• fy(NNP): noun</li></ul> the project moved to another fiscal year legacy project pre <ul style="list-style-type: none"><li>• legacy(JJ):adj</li><li>• project(NN):noun</li><li>• pre(JJ):adj</li></ul> project pre fep <ul style="list-style-type: none"><li>• project(NN):noun</li><li>• pre(JJ):adj</li><li>• FEP(NNP):noun</li></ul> pre fep project <ul style="list-style-type: none"><li>• pre(JJ):adj</li><li>• FEP(NNP):noun</li><li>• project(NN):noun</li></ul> fep project start <ul style="list-style-type: none"><li>• FEP(NNP):noun</li><li>• project(NN):noun</li></ul>

	<ul style="list-style-type: none"> <li>• updated (JJ): other</li> <li>• LNO (NNP): noun</li> <li>• required (VBD): verb</li> </ul> <p>Initial construction CP</p> <ul style="list-style-type: none"> <li>• initial (JJ): other</li> <li>• construction (NN): noun</li> <li>• CP (NNP): noun</li> </ul> <p>Bid Packaging review</p> <ul style="list-style-type: none"> <li>• Bid (NNP): noun</li> <li>• Packaging (NNP): noun</li> <li>• review (NN): noun</li> </ul> <p>Consultant submitting incomplete</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• submitting (VBG): verb</li> <li>• incomplete (JJ): other</li> </ul> <p>FDNY Approval coordination</p> <ul style="list-style-type: none"> <li>• FDNY (NNP): noun</li> <li>• Approval (NNP): noun</li> <li>• coordination (NN): noun</li> </ul> <p>Approval coordination Sponsor</p> <ul style="list-style-type: none"> <li>• Approval (NNP): noun</li> <li>• coordination (NN): noun</li> <li>• Sponsor (NNP): noun</li> </ul> <p>Coordination Sponsor DHS</p> <ul style="list-style-type: none"> <li>• coordination (NN): noun</li> <li>• Sponsor (NNP): noun</li> <li>• DHS (NNP): noun</li> </ul> <p>Design initial construction</p> <ul style="list-style-type: none"> <li>• design (NN): noun</li> <li>• initial (JJ): other</li> <li>• construction (NN): noun</li> </ul> <p>CP submitted DDC</p> <ul style="list-style-type: none"> <li>• CP (NNP): noun</li> <li>• submitted (VBD): verb</li> <li>• DDC (NNP): noun</li> </ul> <p>Submitted DDC review</p> <ul style="list-style-type: none"> <li>• submitted (VBD): verb</li> <li>• DDC (NNP): noun</li> <li>• review (NN): noun</li> </ul> <p>DDC review Due</p> <ul style="list-style-type: none"> <li>• DDC (NNP): noun</li> <li>• review (NN): noun</li> <li>• Due (NNP): noun</li> </ul> <p>Review Due staff</p> <ul style="list-style-type: none"> <li>• review (NN): noun</li> <li>• Due (NNP): noun</li> </ul>	<ul style="list-style-type: none"> <li>• start(VB): verb</li> </ul> <p>This project is either a Legacy project or Pre Front ending plan.</p> <p>project start date</p> <ul style="list-style-type: none"> <li>• project(NN):noun</li> <li>• start(VB): verb</li> <li>• date(NN): noun</li> </ul> <p>Start date moved to another fiscal year.</p> <p>start date input</p> <ul style="list-style-type: none"> <li>• start(VB): verb</li> <li>• date(NN): noun</li> <li>• input(VBD): verb</li> </ul> <p>date input draft</p> <ul style="list-style-type: none"> <li>• date(NN): noun</li> <li>• input(VB): verb</li> <li>• draft(NN):noun</li> </ul> <p>input draft cpi</p> <p>draft cpi receive</p> <ul style="list-style-type: none"> <li>• draft(NN):noun</li> <li>• cpi(NNP): noun</li> <li>• receive(VB):verb</li> </ul> <p>cpi receive date</p> <ul style="list-style-type: none"> <li>• cpi(NNP):noun</li> <li>• receive(VB):verb</li> <li>• date(NN):noun</li> </ul> <p>Project start date input was draft CPI received date.</p> <p>design completion date</p> <ul style="list-style-type: none"> <li>• design(NN):noun</li> <li>• completion(NNP)</li> <li>• date(NN): noun</li> </ul> <p>moved to another date</p> <p>design task order</p> <ul style="list-style-type: none"> <li>• design(NN): noun</li> <li>• task(NN):noun</li> <li>• order(NN):noun</li> </ul> <p>Procurement delay</p> <p>project roll fy</p> <ul style="list-style-type: none"> <li>• project(NN):noun</li> <li>• roll(VB):verb</li> <li>• fy(NNP):noun</li> </ul> <p>another fiscal year</p> <p>dep revise contract</p> <ul style="list-style-type: none"> <li>• DEP(NNP):noun</li> <li>• revise(VB):verb</li> </ul>
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<ul style="list-style-type: none"> <li>• staff (NN): noun</li> </ul> <p>Due staff shortage</p> <ul style="list-style-type: none"> <li>• Due (NNP): noun</li> <li>• staff (NN): noun</li> <li>• shortage (NN): noun</li> </ul> <p>Staff shortage Finance</p> <ul style="list-style-type: none"> <li>• staff (NN): noun</li> <li>• shortage (NN): noun</li> <li>• Finance (NNP): noun</li> </ul> <p>Shortage Finance Procurement</p> <ul style="list-style-type: none"> <li>• shortage (NN): noun</li> <li>• Finance (NNP): noun</li> <li>• Procurement (NNP): noun</li> </ul> <p>Finance Procurement Unit</p> <ul style="list-style-type: none"> <li>• Finance (NNP): noun</li> <li>• Procurement (NNP): noun</li> <li>• Unit (NNP): noun</li> </ul> <p>Procurement Unit unable</p> <ul style="list-style-type: none"> <li>• Procurement (NNP): noun</li> <li>• Unit (NNP): noun</li> <li>• unable (JJ): other</li> </ul> <p>Unit unable review</p> <ul style="list-style-type: none"> <li>• Unit (NNP): noun</li> <li>• unable (JJ): other</li> <li>• review (NN): noun</li> </ul> <p>DDC Design Procurement</p> <ul style="list-style-type: none"> <li>• DDC (NNP): noun</li> <li>• Design (NNP): noun</li> <li>• Procurement (NNP): noun</li> </ul> <p>Design Procurement team</p> <ul style="list-style-type: none"> <li>• Design (NNP): noun</li> <li>• Procurement (NNP): noun</li> <li>• team (NN): noun</li> </ul> <p>Delay attributed consultant</p> <ul style="list-style-type: none"> <li>• Delay (NNP): noun</li> <li>• attributed (VBD): verb</li> <li>• consultant (NN): noun</li> </ul> <p>Attributed consultant submitting</p> <ul style="list-style-type: none"> <li>• attributed (VBD): verb</li> <li>• consultant (NN): noun</li> <li>• submitting (VBG): verb</li> </ul> <p>Submitting incomplete CD</p> <ul style="list-style-type: none"> <li>• submitting (VBG): verb</li> <li>• incomplete (JJ): other</li> <li>• CD (NNP): noun</li> </ul> <p>Incomplete CD specification</p>	<ul style="list-style-type: none"> <li>• contract(NN):noun</li> </ul> <p>revise contract language</p> <ul style="list-style-type: none"> <li>• revise(VB):verb</li> <li>• contract(NN):noun</li> <li>• language(NN):noun</li> </ul> <p>fy sponsor agency</p> <ul style="list-style-type: none"> <li>• fy(NNP): noun</li> <li>• sponsor(NNP):noun</li> <li>• agency(NNP):noun</li> </ul> <p>Moved to another fy by sponsor agency</p> <p>actual design completion</p> <ul style="list-style-type: none"> <li>• actual(JJ):adj</li> <li>• design(VB):verb</li> <li>• completion(NN):noun</li> </ul> <p>revised due to rebid</p> <p>design service suspend</p> <ul style="list-style-type: none"> <li>• design (VB):verb</li> <li>• service(NN):noun</li> <li>• suspend(VBD):verb</li> </ul> <p>move project fy</p> <ul style="list-style-type: none"> <li>• move(VB): verb</li> <li>• project(NN):noun</li> <li>• fy(NNP):noun</li> </ul> <p>move fy fy</p> <p>from one fiscal year to another</p> <ul style="list-style-type: none"> <li>• move(VB): verb</li> <li>• fy(NNP):noun</li> <li>• fy(NNP):noun</li> </ul> <p>roll fy sponsor</p> <ul style="list-style-type: none"> <li>• Roll (VB): verb</li> <li>• fy(NNP):noun</li> <li>• sponsor((NN):noun</li> </ul> <p>april plan project</p> <ul style="list-style-type: none"> <li>• april(NNP):noun</li> <li>• plan(VB):verb</li> <li>• project(NN):noun</li> </ul> <p>The project moved to another fiscal year on april 2022.</p> <p>acquisition process project</p> <ul style="list-style-type: none"> <li>• acquisition(NN):noun</li> <li>• process(NN):noun</li> <li>• project(NN):noun</li> </ul> <p>Delay caused the project in acquisition process.</p> <p>put project onhold</p>
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	<ul style="list-style-type: none"> <li>• incomplete (JJ): other</li> <li>• CD (NNP): noun</li> <li>• specification (NN): noun</li> </ul> <p>CD specification estimate</p> <ul style="list-style-type: none"> <li>• CD (NNP): noun</li> <li>• specification (NN): noun</li> <li>• estimate (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>• put(VB):verb</li> <li>• project(NN):noun</li> <li>• onhold(JJ):adj</li> </ul> <p>dep request add</p> <ul style="list-style-type: none"> <li>• DEP(NNP):noun</li> <li>• request(VB):verb</li> <li>• add(VB):verb</li> </ul> <p>DEP request to add additional language on the contract.</p> <p>problem new system</p> <ul style="list-style-type: none"> <li>• problem(NN):noun</li> <li>• new(JJ):adj</li> <li>• system(NN):noun</li> </ul> <p>new system passport</p> <ul style="list-style-type: none"> <li>• new(JJ):adj</li> <li>• system(NN):noun</li> <li>• Passport(NNP):noun</li> </ul> <p>problem with the new system called passport</p> <p>scope change bioswales</p> <ul style="list-style-type: none"> <li>• scope(NN):noun</li> <li>• change(VB):verb</li> <li>• bioswales(NNP):noun</li> </ul>
<b>Bid</b> (Construction Procurement)	<p>site safety plan:</p> <ul style="list-style-type: none"> <li>• site (NN): noun</li> <li>• safety (NN): noun</li> <li>• plan (NN): noun</li> </ul> <p>abated architectural drawing:</p> <ul style="list-style-type: none"> <li>• abated (VBN): verb</li> <li>• architectural (JJ): adjective</li> <li>• drawing (NN): noun</li> </ul> <p>bpl lighting consultant:</p> <ul style="list-style-type: none"> <li>• bpl (NNP): proper noun</li> <li>• lighting (NN): noun</li> <li>• consultant (NN): noun</li> </ul> <p>sub responding consultant:</p> <ul style="list-style-type: none"> <li>• sub (NN): noun</li> <li>• responding (VBG): verb</li> <li>• consultant (NN): noun</li> </ul> <p>spot abatement abatement:</p> <ul style="list-style-type: none"> <li>• spot (NN): noun</li> <li>• abatement (NN): noun</li> <li>• abatement (NN): noun</li> </ul> <p>sponsor delay securing:</p> <ul style="list-style-type: none"> <li>• sponsor (NN): noun</li> </ul>	<p>project move fy:</p> <ul style="list-style-type: none"> <li>• project(NN):noun</li> <li>• move(VB):verb</li> <li>• fy(NNP):noun</li> </ul> <p>procurement delay due</p> <ul style="list-style-type: none"> <li>• procurement(NN): noun</li> <li>• delay(VB):verb</li> <li>• due(JJ):adj</li> </ul> <p>delay due new</p> <ul style="list-style-type: none"> <li>• delay(VB):verb</li> <li>• due(JJ):adj</li> <li>• new(JJ):adj</li> </ul> <p>due new system</p> <ul style="list-style-type: none"> <li>• due(JJ):adj</li> <li>• new(JJ):adj</li> <li>• system(NN):noun</li> </ul> <p>new system passport</p> <ul style="list-style-type: none"> <li>• new(NN):noun</li> <li>• system(NN):noun</li> <li>• passport(NN):noun</li> </ul> <p>contract register ntp</p> <ul style="list-style-type: none"> <li>• contract(NN):noun</li> </ul>

	<ul style="list-style-type: none"> <li>• delay (NN): noun</li> <li>• securing (VBG): verb</li> </ul> <p>resubmitted budget cp:</p> <ul style="list-style-type: none"> <li>• resubmitted (VBD): verb</li> <li>• budget (NN): noun</li> <li>• cp (NN): noun</li> </ul> <p>resubmit bid package:</p> <ul style="list-style-type: none"> <li>• resubmit (VB): verb</li> <li>• bid (NN): noun</li> <li>• package (NN): noun</li> </ul> <p>responding consultant request:</p> <ul style="list-style-type: none"> <li>• responding (VBG): verb</li> <li>• consultant (NN): noun</li> <li>• request (NN): noun</li> </ul> <p>requested cp see:</p> <ul style="list-style-type: none"> <li>• requested (VBD): verb</li> <li>• cp (NN): noun</li> <li>• see (VB): verb</li> </ul> <p>opening postponed time:</p> <ul style="list-style-type: none"> <li>• opening (NN): noun</li> <li>• postponed (VBN): verb</li> <li>• time (NN): noun</li> </ul> <p>open bid bid:</p> <ul style="list-style-type: none"> <li>• open (JJ): adjective</li> <li>• bid (NN): noun</li> <li>• bid (NN): noun</li> </ul> <p>omb reviewed ewa:</p> <ul style="list-style-type: none"> <li>• omb (NNP): proper noun</li> <li>• reviewed (VBD): verb</li> <li>• ewa (NN): noun</li> </ul> <p>omb review approval:</p> <ul style="list-style-type: none"> <li>• omb (NNP): proper noun</li> <li>• review (NN): noun</li> <li>• approval (NN): noun</li> </ul> <p>omb requested cp:</p> <ul style="list-style-type: none"> <li>• omb (NNP): proper noun</li> <li>• requested (VBD): verb</li> <li>• cp (NN): noun</li> </ul> <p>issue associated pql:</p> <ul style="list-style-type: none"> <li>• issue (NN): noun</li> <li>• associated (VBN): verb</li> <li>• pql (NN): noun</li> </ul> <p>institution ddc manage:</p> <ul style="list-style-type: none"> <li>• institution (NN): noun</li> <li>• ddc (NNP): proper noun</li> <li>• manage (VBP): verb</li> </ul>	<ul style="list-style-type: none"> <li>• register (VB): verb</li> <li>• ntp (NN): noun</li> </ul> <p>register ntp issue</p> <ul style="list-style-type: none"> <li>• register (VB): verb</li> <li>• ntp (NN): noun</li> <li>• issue (NN): noun</li> </ul> <p>cp approval omb</p> <ul style="list-style-type: none"> <li>• cp (NN): noun</li> <li>• approval (NN): noun</li> <li>• omb (NN): noun</li> </ul> <p>Rei procurement delay</p> <ul style="list-style-type: none"> <li>• rei (NNP): noun</li> <li>• procurement (NN): noun</li> <li>• delay (NN): noun</li> </ul> <p>cp approval delay</p> <ul style="list-style-type: none"> <li>• cp (NN): noun</li> <li>• approval (NN): noun</li> <li>• delay (NN): noun</li> </ul> <p>cp submit omb</p> <ul style="list-style-type: none"> <li>• cp (NN): noun</li> <li>• submit (VB): verb</li> <li>• omb (NN): noun</li> </ul> <p>move bid date</p> <ul style="list-style-type: none"> <li>• move (VB): verb</li> <li>• bid (NN): noun</li> <li>• date (NN): noun</li> </ul> <p>amend design cp</p> <ul style="list-style-type: none"> <li>• amend (VB): verb</li> <li>• design (NN): noun</li> <li>• cp (NN): noun</li> </ul> <p>rei task order</p> <ul style="list-style-type: none"> <li>• rei (NNP): noun</li> <li>• task (NN): noun</li> <li>• order (NN): noun</li> </ul> <p>eo due diligence</p> <ul style="list-style-type: none"> <li>• eo (NN): noun</li> <li>• due (NN): noun</li> <li>• diligence (NN): noun</li> </ul> <p>due diligence memo</p> <ul style="list-style-type: none"> <li>• due (NN): noun</li> <li>• diligence (NN): noun</li> <li>• memo (NN): noun</li> </ul> <p>bid open postpone</p> <ul style="list-style-type: none"> <li>• bid (NN): noun</li> <li>• open (VB): verb</li> <li>• postpone (VB): verb</li> </ul>
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	<p>cp sent omb:</p> <ul style="list-style-type: none"> <li>• cp (NN): noun</li> <li>• sent (VBD): verb</li> <li>• omb (NNP): proper noun</li> </ul> <p>call entire basement:</p> <ul style="list-style-type: none"> <li>• call (NN): noun</li> <li>• entire (JJ): adjective</li> <li>• basement (NN): noun</li> </ul> <p>budget cp sent:</p> <ul style="list-style-type: none"> <li>• budget (NN): noun</li> <li>• cp (NN): noun</li> <li>• sent (VBD): verb</li> </ul> <p>brought light walkthrough:</p> <ul style="list-style-type: none"> <li>• brought (VBD): verb</li> <li>• light (NN): noun</li> <li>• walkthrough (NN): noun</li> </ul> <p>breakdown requested contractor:</p> <ul style="list-style-type: none"> <li>• breakdown (NN): noun</li> <li>• requested (VBD): verb</li> <li>• contractor (NN): noun</li> </ul> <p>breakdown area cp:</p> <ul style="list-style-type: none"> <li>• breakdown (NN): noun</li> <li>• area (NN): noun</li> <li>• cp (NN): noun</li> </ul> <p>breakdown area consultant:</p> <ul style="list-style-type: none"> <li>• breakdown (NN): noun</li> <li>• area (NN): noun</li> <li>• consultant (NN): noun</li> </ul>	<p>open postpone due</p> <ul style="list-style-type: none"> <li>• open(VB):verb</li> <li>• postpone(VB):verb</li> <li>• due(JJ):adj</li> </ul> <p>postpone due omb</p> <ul style="list-style-type: none"> <li>• postpone(VB):verb</li> <li>• due(JJ):adj</li> <li>• omb(NN):noun</li> </ul> <p>omb pause outbreak</p> <ul style="list-style-type: none"> <li>• omb(NN):noun</li> <li>• pause(VB):verb</li> <li>• outbreak(NN):noun</li> </ul> <p>revision buffer surface</p> <ul style="list-style-type: none"> <li>• revision(NN):noun</li> <li>• buffer(NN):noun</li> <li>• surface(NN):noun</li> </ul> <p>buffer surface grade</p> <ul style="list-style-type: none"> <li>• buffer(NN):noun</li> <li>• surface(NN):noun</li> <li>• grade(NN):noun</li> </ul> <p>surface grade request</p> <ul style="list-style-type: none"> <li>• surface(NN):noun</li> <li>• grade(NN):noun</li> <li>• request(NN):noun</li> </ul> <p>grade request ddc</p> <ul style="list-style-type: none"> <li>• grade(NN):noun</li> <li>• request(NN):noun</li> <li>• ddc(NN):noun</li> </ul> <p>request ddc public</p> <ul style="list-style-type: none"> <li>• request(NN):noun</li> <li>• ddc(NN):noun</li> <li>• public(JJ):adj</li> </ul> <p>ddc public building</p> <ul style="list-style-type: none"> <li>• ddc(NN):noun</li> <li>• public(JJ):adj</li> <li>• building(NN):noun</li> </ul> <p>bid open move</p> <ul style="list-style-type: none"> <li>• bid(NN):noun</li> <li>• open(VB):verb</li> <li>• move(VB):verb</li> </ul> <p>open move due</p> <ul style="list-style-type: none"> <li>• open(VB):verb</li> <li>• mover(VB):verb</li> <li>• due(JJ):adj</li> </ul> <p>move due original</p> <ul style="list-style-type: none"> <li>• move(VB):verb</li> </ul>
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		<ul style="list-style-type: none"> <li>• due(JJ):adj</li> <li>• original(JJ):adj</li> </ul>
<b>Build</b> (Construction and Closeout)	time extension approval <ul style="list-style-type: none"> <li>• time (NNP): noun</li> <li>• extension (NNP): noun</li> <li>• approval (NN): noun</li> </ul> fire alarm device <ul style="list-style-type: none"> <li>• fire (NN): noun</li> <li>• alarm (NN): noun</li> <li>• device (NN): noun</li> </ul> court decide install <ul style="list-style-type: none"> <li>• court (NNP): noun</li> <li>• decide (VBP): verb</li> <li>• install (JJ): other</li> </ul> decide install fire <ul style="list-style-type: none"> <li>• decide (VBP): verb</li> <li>• install (JJ): other</li> <li>• fire (NN): noun</li> </ul> install fire alarm <ul style="list-style-type: none"> <li>• install (JJ): other</li> <li>• fire (NN): noun</li> <li>• alarm (NN): noun</li> </ul> alarm device courtroom <ul style="list-style-type: none"> <li>• alarm (NN): noun</li> <li>• device (NN): noun</li> <li>• courtroom (NN): noun</li> </ul> device courtroom lobby <ul style="list-style-type: none"> <li>• device (NN): noun</li> <li>• courtroom (NN): noun</li> <li>• lobby (NN): noun</li> </ul> courtroom lobby affect <ul style="list-style-type: none"> <li>• courtroom (NN): noun</li> <li>• lobby (NN): noun</li> <li>• affect (JJ): other</li> </ul> lobby affect contractor <ul style="list-style-type: none"> <li>• lobby (NN): noun</li> <li>• affect (JJ): other</li> <li>• contractor (NN): noun</li> </ul> affect contractor planning <ul style="list-style-type: none"> <li>• affect (JJ): other</li> <li>• contractor (NN): noun</li> <li>• planning (NN): noun</li> </ul> contractor planning work <ul style="list-style-type: none"> <li>• contractor (NN): noun</li> <li>• planning (NN): noun</li> </ul>	facility direct interference <ul style="list-style-type: none"> <li>• facility(NN):noun</li> <li>• direct(JJ):adj</li> <li>• interference(NN):noun</li> </ul> con edison electric <ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• electric(NN):noun</li> </ul> direct interference propose <ul style="list-style-type: none"> <li>• direct(JJ):adj</li> <li>• interference(NN):noun</li> <li>• propose(VB): verb</li> </ul> con edison gas <ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• gas(NN):non</li> </ul> new gas main replace new gas main <ul style="list-style-type: none"> <li>• new(JJ):adj</li> <li>• gas(NN):noun</li> <li>• main(NN):noun</li> </ul> contractor stop work <ul style="list-style-type: none"> <li>• contractor(NNP):noun</li> <li>• stop(VB):verb</li> <li>• work(VB):verb</li> </ul> Contractor stopped work to go to another job/Contractor stopped working due to HPD funding shortage. trunk water main <ul style="list-style-type: none"> <li>• trunk(NN): noun</li> <li>• water(NN):noun</li> <li>• main(NN):noun</li> </ul> Electric oil-o-static lines conflict with steel trunk water mains work. con edison facility <ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• facility(NN):noun</li> </ul> relocation of Con Edison facility stop work due <ul style="list-style-type: none"> <li>• stop (VB):verb</li> <li>• work(VB):verb</li> </ul>

<ul style="list-style-type: none"> <li>• work (NN): noun</li> </ul> <p>Court did not decide if they will install fire alarm devices on courtroom and lobby which will affect the contractor planning for work.</p> <p>approved delay associated</p> <ul style="list-style-type: none"> <li>• approved (VBD): verb</li> <li>• delay (NN): noun</li> <li>• associated (VBN): verb</li> </ul> <p>part approved time</p> <ul style="list-style-type: none"> <li>• part (NN): noun</li> <li>• approved (VBD): verb</li> <li>• time (NNP): noun</li> </ul> <p>approved time extension</p> <ul style="list-style-type: none"> <li>• approved (VBD): verb</li> <li>• time (NNP): noun</li> <li>• extension (NNP): noun</li> </ul> <p>Delay in EOR to Provide Sketch for RFI # 37 &amp; 39: A/EOR answered RFI 37 and 39 regarding existing sanitary, condensate and steam lines in the way of the fuel oil tank room but did not provide a sketch two months after the RFI was answered. The approved delays associated with this item are included in the approved Time Extension #1 approval.</p> <p>delay associated work</p> <ul style="list-style-type: none"> <li>• delay (NN): noun</li> <li>• associated (VBN): verb</li> <li>• work (NN): noun</li> </ul> <p>associated work included</p> <ul style="list-style-type: none"> <li>• associated (VBN): verb</li> <li>• work (NN): noun</li> <li>• included (VBD): verb</li> </ul> <p>work included item</p> <ul style="list-style-type: none"> <li>• work (NN): noun</li> <li>• included (VBD): verb</li> <li>• item (NNP): noun</li> </ul> <p>included item part</p> <ul style="list-style-type: none"> <li>• included (VBD): verb</li> <li>• item (NNP): noun</li> <li>• part (NN): noun</li> </ul> <p>item part approved</p> <ul style="list-style-type: none"> <li>• item (NNP): noun</li> <li>• part (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>• due(VBD):verb</li> </ul> <p>stop work due to heat contingency</p> <p>interference propose city</p> <ul style="list-style-type: none"> <li>• interference(NN):noun</li> <li>• propose(VBD): verb</li> <li>• city(NN):noun</li> </ul> <p>contractor hand dig</p> <ul style="list-style-type: none"> <li>• Contractor (NNP):noun</li> <li>• Hand(NN):noun</li> <li>• dig(VB):verb</li> </ul> <p>con edison electrical</p> <ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• electric(NN):noun</li> </ul> <p>work due hpd</p> <p>due hpd funding</p> <ul style="list-style-type: none"> <li>• due(VBD):verb</li> <li>• HPD(NNP):noun</li> <li>• funding(NN):noun</li> </ul> <p>due to HPD funding shortage</p> <p>hpd funding shortage</p> <ul style="list-style-type: none"> <li>• HPD(NNP):noun</li> <li>• funding(NN):noun</li> <li>• shortage(NNP):noun</li> </ul> <p>gas main install</p> <ul style="list-style-type: none"> <li>• Gas (NN):noun</li> <li>• main(NN):noun</li> <li>• install(VB):verb</li> </ul> <p>religious holiday per</p> <ul style="list-style-type: none"> <li>• religious(JJ):adj</li> <li>• holiday(NN):noun</li> </ul> <p>religious holiday as per DDC</p> <p>national grid interference</p> <ul style="list-style-type: none"> <li>• national(JJ):adj</li> <li>• grid(NN):noun</li> <li>• interference(NN):noun</li> </ul> <p>due gas crossing</p> <ul style="list-style-type: none"> <li>• due(VBD):verb</li> <li>• gas(NN):noun</li> <li>• crossing(VBG):verb</li> </ul> <p>gas crossing electrical</p> <ul style="list-style-type: none"> <li>• gas(NN):noun</li> <li>• crossing(VBD):verb</li> <li>• electrical(JJ):adj</li> </ul> <p>crossing electrical duct</p> <ul style="list-style-type: none"> <li>• crossing(VBD):verb</li> </ul>
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	<ul style="list-style-type: none"> <li>• approved (VBD): verb</li> </ul> <p>construction start date <a href="#">rescheduled</a></p> <ul style="list-style-type: none"> <li>• construction (NN): noun</li> <li>• start (NN): noun</li> <li>• date (NN): noun</li> </ul> <p>fuel oil tank</p> <ul style="list-style-type: none"> <li>• fuel (NN): noun</li> <li>• oil (NN): noun</li> <li>• tank (NN): noun</li> </ul> <p><a href="#">This leak prevented us from waterproofing the existing slab of the fuel oil tank room. The approved delays associated with this item are included in the approved Time Extension #1 approval.</a></p> <p>shaft work ccds</p> <ul style="list-style-type: none"> <li>• shaft (NNP): noun</li> <li>• work (NN): noun</li> <li>• ccds (NN): noun</li> </ul> <p>work ccds lpc</p> <ul style="list-style-type: none"> <li>• work (NN): noun</li> <li>• ccds (NN): noun</li> <li>• lpc (NNP): noun</li> </ul> <p><a href="#">Shaft A work – 22% - 22.00 ccds. LPC Approved changes – space designs reconfiguration. 55% 55.00 ccds.</a></p> <p>expose existing deteriorated</p> <ul style="list-style-type: none"> <li>• expose (VBD): verb</li> <li>• existing (VBG): verb</li> <li>• deteriorated (VBN): verb</li> </ul> <p>existing deteriorated collapsed</p> <ul style="list-style-type: none"> <li>• existing (VBG): verb</li> <li>• deteriorated (VBN): verb</li> <li>• collapsed (JJ): other</li> </ul> <p>deteriorated collapsed sewer</p> <ul style="list-style-type: none"> <li>• deteriorated (VBN): verb</li> <li>• collapsed (JJ): other</li> <li>• sewer (NN): noun</li> </ul> <p>collapsed sewer main</p> <ul style="list-style-type: none"> <li>• collapsed (JJ): other</li> <li>• sewer (NN): noun</li> <li>• main (JJ): other</li> </ul> <p>complete original scope</p> <ul style="list-style-type: none"> <li>• complete (JJ): other</li> <li>• original (JJ): other</li> <li>• scope (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>• electrical(JJ):adj</li> <li>• duct(NN):noun</li> </ul> <p><a href="#">due to gas crossing and electrical ducts</a></p> <p>contractor schedule support</p> <ul style="list-style-type: none"> <li>• contractor(NNP):noun</li> <li>• schedule(VBD):verb</li> <li>• support(VBD):verb</li> </ul> <p><a href="#">The contractor was scheduled to support Con Edison.</a></p> <p>water main installation</p> <ul style="list-style-type: none"> <li>• water(NN):noun</li> <li>• main(NN):noun</li> <li>• install(VBD):verb</li> </ul> <p>due inclement weather</p> <ul style="list-style-type: none"> <li>• due(VBD): verb</li> <li>• inclement(JJ):ADJ</li> <li>• weather(NN):noun</li> </ul> <p>edison facility direct</p> <ul style="list-style-type: none"> <li>• con-edison(NNP)noun</li> <li>• facility(NN):noun</li> <li>• direct(JJ):adj</li> </ul> <p>contractor decide work</p> <ul style="list-style-type: none"> <li>• contractor(NN):noun</li> <li>• decide(VBD):verb</li> <li>• work(VBD):verb</li> </ul> <p><a href="#">Contractor decided not to work.</a></p> <p>excavation safety alert</p> <ul style="list-style-type: none"> <li>• Excavation (NN):noun</li> <li>• safety(NN):noun</li> <li>• alert(NN):noun</li> </ul> <p>ave due gas</p> <ul style="list-style-type: none"> <li>• Ave (NNP):noun</li> <li>• due(VBD):verb</li> <li>• gas(NN):noun</li> </ul> <p><a href="#">41st to 44th Street b/n 1 Ave to 4 Ave due to gas crossing and electrical ducts.</a></p> <p>stop work order</p> <ul style="list-style-type: none"> <li>• Stop(VB):verb</li> <li>• work(NN):noun</li> <li>• order(NN):noun</li> </ul> <p><a href="#">NYCDDC or Con-Edison stopped work order.</a></p>
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	<p>Dorm 1 - Excavate to expose existing deteriorated and collapsed sewer mains. This additional work was needed to complete the original scope.</p> <p>construction staging area</p> <ul style="list-style-type: none"> <li>• construction (NN): noun</li> <li>• staging (VBG): verb</li> <li>• area (NN): noun</li> </ul> <p>Staging area usage by DHS; West courtyard was taken over by DHS for parking. Contractually this area is designated as construction staging area and allowing general public access for parking creates various liability issues. NSP has claimed delay regarding access to the construction staging area. The approved delays associated with this work are included with Item #7 and are part of the approved Time Extension #1 approval.</p> <p>fund CA phase</p> <ul style="list-style-type: none"> <li>• fund (NN): noun</li> <li>• CA (NNP): noun</li> <li>• phase (NN): noun</li> </ul>	
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### Top 30 4-grams Frequency:

The extension to 4-gram frequency reduces duplication and related terms. For example, during the design phase, the 4-grams approach combines the two trigram keywords ('initial construction cp' and 'design initial construction') into the complete phrase 'design initial construction cp'. This extension effectively eliminates redundant terms and enhances the specificity of keyword analysis.

Phase	Public Building	Infrastructure
<b>Design</b> (Design and Initiation)	schedule revised reflect delay <ul style="list-style-type: none"> <li>• schedule (NN): noun</li> <li>• revised (VBD): verb</li> <li>• reflect (JJ): other</li> <li>• delay (NN): noun</li> </ul> revised reflect delay caused	legacy project pre fep <ul style="list-style-type: none"> <li>• legacy(JJ):adj</li> <li>• project(NN):noun</li> <li>• pre(JJ):adj</li> <li>• FEP(NNP):noun</li> </ul>

	<ul style="list-style-type: none"> <li>revised (VBD): verb</li> <li>reflect (JJ): other</li> <li>delay (NN): noun</li> <li>caused (VBD): verb</li> </ul> <p>updated LNO required FDNY</p> <ul style="list-style-type: none"> <li>updated (JJ): other</li> <li>LNO (NNP): noun</li> <li>required (VBD): verb</li> <li>FDNY (NNP): noun</li> </ul> <p>FDNY Approval coordination Sponsor</p> <ul style="list-style-type: none"> <li>FDNY (NNP): noun</li> <li>Approval (NNP): noun</li> <li>coordination (NN): noun</li> <li>Sponsor (NNP): noun</li> </ul> <p>Approval coordination Sponsor DHS</p> <ul style="list-style-type: none"> <li>Approval (NNP): noun</li> <li>coordination (NN): noun</li> <li>Sponsor (NNP): noun</li> <li>DHS (NNP): noun</li> </ul> <p>design initial construction CP</p> <ul style="list-style-type: none"> <li>design (NN): noun</li> <li>initial (JJ): other</li> <li>construction (NN): noun</li> <li>CP (NNP): noun</li> </ul> <p>CP submitted DDC review</p> <ul style="list-style-type: none"> <li>CP (NNP): noun</li> <li>submitted (VBD): verb</li> <li>DDC (NNP): noun</li> <li>review (NN): noun</li> </ul> <p>submitted DDC review Due, <a href="#">related to the next 7 4-grams word, due to staff shortage, Finance and Procurement unit was unable to review the CP submitted</a></p> <ul style="list-style-type: none"> <li>submitted (VBD): verb</li> <li>DDC (NNP): noun</li> <li>review (NN): noun</li> <li>Due (NNP): noun</li> </ul> <p>DDC review Due staff</p> <ul style="list-style-type: none"> <li>DDC (NNP): noun</li> <li>review (NN): noun</li> <li>Due (NNP): noun</li> <li>staff (NN): noun</li> </ul> <p>review Due staff shortage</p> <ul style="list-style-type: none"> <li>review (NN): noun</li> <li>Due (NNP): noun</li> <li>staff (NN): noun</li> </ul>	<p><a href="#">Legacy project / Pre -FEP. Project start date input was draft CPI received date.</a></p> <p>project pre fep project</p> <ul style="list-style-type: none"> <li>project(NN):noun</li> <li>pre(JJ):adj</li> <li>FEP(NNP):noun</li> <li>project(NN):noun</li> </ul> <p>pre fep project start</p> <ul style="list-style-type: none"> <li>pre(JJ):adj</li> <li>FEP(NNP):noun</li> <li>project(NN):noun</li> <li>start(VBD):verb</li> </ul> <p>fep project start date</p> <ul style="list-style-type: none"> <li>FEP(NNP):noun</li> <li>project(NN):noun</li> <li>start(VBD):verb</li> <li>date(NN):noun</li> </ul> <p>project start date input</p> <ul style="list-style-type: none"> <li>project(NN):noun</li> <li>start(VBD):verb</li> <li>date(NN):noun</li> <li>input(VBD): verb</li> </ul> <p>start date input draft</p> <ul style="list-style-type: none"> <li>start(VBD):verb</li> <li>date(NN): noun</li> <li>input(VBD): verb</li> <li>draft(NN):noun</li> </ul> <p>date input draft cpi</p> <ul style="list-style-type: none"> <li>date(NN): noun</li> <li>input(VBD): verb</li> <li>draft(NN):noun</li> <li>cpi(NNP): noun</li> </ul> <p>input draft cpi receive</p> <ul style="list-style-type: none"> <li>input(VBD): verb</li> <li>draft(NN):noun</li> <li>cpi(NNP): noun</li> <li>receive(VBD):verb</li> </ul> <p>draft cpi receive date</p> <ul style="list-style-type: none"> <li>draft(NN):noun</li> <li>cpi(NNP): noun</li> <li>receive(VBD):verb</li> <li>date(NN):noun</li> </ul> <p>dep revise contract language</p> <ul style="list-style-type: none"> <li>DEP(NNP):noun</li> <li>revise(VBD):verb</li> </ul>
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<ul style="list-style-type: none"> <li>• shortage (NN): noun</li> </ul> <p>Due staff shortage Finance</p> <ul style="list-style-type: none"> <li>• Due (NNP): noun</li> <li>• staff (NN): noun</li> <li>• shortage (NN): noun</li> <li>• Finance (NNP): noun</li> </ul> <p>Staff shortage Finance Procurement</p> <ul style="list-style-type: none"> <li>• staff (NN): noun</li> <li>• shortage (NN): noun</li> <li>• Finance (NNP): noun</li> <li>• Procurement (NNP): noun</li> </ul> <p>Shortage Finance procurement Unit</p> <ul style="list-style-type: none"> <li>• shortage (NN): noun</li> <li>• Finance (NNP): noun</li> <li>• Procurement (NNP): noun</li> <li>• Unit (NNP): noun</li> </ul> <p>Finance Procurement Unit unable</p> <ul style="list-style-type: none"> <li>• Finance (NNP): noun</li> <li>• Procurement (NNP): noun</li> <li>• Unit (NNP): noun</li> <li>• unable (JJ): other</li> </ul> <p>Procurement Unit unable review</p> <ul style="list-style-type: none"> <li>• Procurement (NNP): noun</li> <li>• Unit (NNP): noun</li> <li>• unable (JJ): other</li> <li>• review (NN): noun</li> </ul> <p>DDC Design Procurement team</p> <ul style="list-style-type: none"> <li>• DDC (NNP): noun</li> <li>• Design (NNP): noun</li> <li>• Procurement (NNP): noun</li> <li>• team (NN): noun</li> </ul> <p>Delay attributed consultant submitting</p> <ul style="list-style-type: none"> <li>• Delay (NNP): noun</li> <li>• attributed (VBD): verb</li> <li>• consultant (NN): noun</li> <li>• submitting (VBG): verb</li> </ul> <p>Attributed consultant submitting incomplete</p> <ul style="list-style-type: none"> <li>• attributed (VBD): verb</li> <li>• consultant (NN): noun</li> <li>• submitting (VBG): verb</li> <li>• incomplete (JJ): other</li> </ul> <p>Consultant submitting incomplete CD, refer to incomplete 75% CD's, specification and estimate</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>• contract(NN):noun</li> <li>• language(NNP):noun</li> </ul> <p>project roll fy sponsor</p> <ul style="list-style-type: none"> <li>• project(NN):noun</li> <li>• Roll (VBD): verb</li> <li>• fy(NNP):noun</li> <li>• sponsor((NN):noun</li> </ul> <p>Sponsor agency moved to fiscal year 24/25</p> <p>roll fy sponsor agency</p> <ul style="list-style-type: none"> <li>• Roll (VBD): verb</li> <li>• fy(NNP):noun</li> <li>• sponsor((NN):noun</li> <li>• agency(NN):noun</li> </ul> <p>project move fy fy</p> <ul style="list-style-type: none"> <li>• project(NN):noun</li> <li>• move(VBD): verb</li> <li>• fy(NNP):noun</li> <li>• fy(NNP):noun</li> </ul> <p>actual design completion date</p> <ul style="list-style-type: none"> <li>• actual(JJ):adj</li> <li>• design(VBD):verb</li> <li>• completion(NN):noun</li> <li>• date(NN):noun</li> </ul> <p>problem new system passport</p> <ul style="list-style-type: none"> <li>• problem(NN):noun</li> <li>• new(JJ):adj</li> <li>• system(NN):noun</li> <li>• passport(NNP):noun</li> </ul> <p>scope change bioswales porous</p> <ul style="list-style-type: none"> <li>• scope(NN):noun</li> <li>• change(VBD):verb</li> <li>• bioswales(NNP): noun</li> <li>• Porous (JJ):adj</li> </ul> <p>Scope change from Bioswales to Porous pavement generated the need for complete design change.</p> <p>change bioswales porous pavement</p> <ul style="list-style-type: none"> <li>• change(VBD):verb</li> <li>• bioswales(NNP):noun</li> <li>• Porous (JJ):adj</li> <li>• pavement(NN):noun</li> </ul> <p>bioswales porous pavement generate</p> <ul style="list-style-type: none"> <li>• bioswales(NNP):noun</li> </ul>
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	<ul style="list-style-type: none"> <li>submitting (VBG): verb</li> <li>incomplete (JJ): other</li> <li>CD (NNP): noun</li> </ul> <p>Submitting incomplete CD specification</p> <ul style="list-style-type: none"> <li>submitting (VBG): verb</li> <li>incomplete (JJ): other</li> <li>CD (NNP): noun</li> <li>specification (NN): noun</li> </ul> <p>Incomplete CD specification estimate</p> <ul style="list-style-type: none"> <li>incomplete (JJ): other</li> <li>CD (NNP): noun</li> <li>specification (NN): noun</li> <li>estimate (NN): noun</li> </ul> <p>Delay completion CD document</p> <ul style="list-style-type: none"> <li>Delay (NNP): noun</li> <li>completion (NN): noun</li> <li>CD (NNP): noun</li> <li>document (NN): noun</li> </ul> <p>Completion CD document submission</p> <ul style="list-style-type: none"> <li>completion (NN): noun</li> <li>CD (NNP): noun</li> <li>document (NN): noun</li> <li>submission (NN): noun</li> </ul> <p>Obra DD Submission found</p> <ul style="list-style-type: none"> <li>Obra (NNP): noun</li> <li>DD (NNP): noun</li> <li>submission (NN): noun</li> <li>found (VBD): verb</li> </ul> <p>DD submission found unsatisfactory</p> <ul style="list-style-type: none"> <li>DD (NNP): noun</li> <li>submission (NN): noun</li> <li>found (VBD): verb</li> <li>unsatisfactory (JJ): other</li> </ul> <p>Submission found unsatisfactory pushed</p> <ul style="list-style-type: none"> <li>submission (NN): noun</li> <li>found (VBD): verb</li> <li>unsatisfactory (JJ): other</li> <li>pushed (VBN): verb</li> </ul> <p>Found unsatisfactory pushed back</p> <ul style="list-style-type: none"> <li>found (VBD): verb</li> <li>unsatisfactory (JJ): other</li> <li>pushed (VBN): verb</li> <li>back (RP): other</li> </ul> <p>Unsatisfactory pushed back schedule, refer to <a href="#">Obra's D and DD submission</a></p> <ul style="list-style-type: none"> <li>unsatisfactory (JJ): other</li> </ul>	<ul style="list-style-type: none"> <li>Porous (JJ):adj</li> <li>pavement(NN):noun</li> <li>generate(VBD):verb</li> </ul> <p>porous pavement generate need</p> <ul style="list-style-type: none"> <li>Porous (JJ):adj</li> <li>pavement(NN):noun</li> <li>generate(VBD):verb</li> <li>need(VBD):verb</li> </ul> <p>pavement generate need complete</p> <ul style="list-style-type: none"> <li>pavement(NN):noun</li> <li>generate(VBD):verb</li> <li>need(VBD):verb</li> <li>complete(VBD):verb</li> </ul> <p>generate need complete design</p> <ul style="list-style-type: none"> <li>generate(VBD):verb</li> <li>need(VBD):verb</li> <li>complete(VBD):verb</li> <li>design(NN):noun</li> </ul> <p>need complete design change</p> <ul style="list-style-type: none"> <li>need(VBD):verb</li> <li>complete(VBD):verb</li> <li>design(NN):noun</li> <li>change(VBD):verb</li> </ul> <p>design task order procurement</p> <ul style="list-style-type: none"> <li>Design(VBD):verb</li> <li>task(NN):noun</li> <li>order(NN):noun</li> <li>procurement(NN):noun</li> </ul> <p>post construction storm water</p> <ul style="list-style-type: none"> <li>post(JJ):adj</li> <li>construction(NN):noun</li> <li>storm(NN):noun</li> <li>water(NN):noun</li> </ul> <p>construction storm water management</p> <ul style="list-style-type: none"> <li>construction(NN):noun</li> <li>storm(NN):noun</li> <li>water(NN):noun</li> <li>management(NN)</li> </ul> <p>storm water management practice</p> <ul style="list-style-type: none"> <li>storm(NN):noun</li> <li>water(NN):noun</li> <li>management(NN)</li> <li>practice(NN):noun</li> </ul>
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	<ul style="list-style-type: none"> <li>• pushed (VBN): verb</li> <li>• back (RP): other</li> <li>• schedule (NN): noun</li> </ul> <p>Obra proving inefficient managing</p> <ul style="list-style-type: none"> <li>• Obra (NNP): noun</li> <li>• proving (VBG): verb</li> <li>• inefficient (JJ): other</li> <li>• managing (VBG): verb</li> </ul> <p>Proving inefficient managing coordination</p> <ul style="list-style-type: none"> <li>• proving (VBG): verb</li> <li>• inefficient (JJ): other</li> <li>• managing (VBG): verb</li> <li>• Coordination (NNP): noun</li> </ul>	<p>the project now requires post construction stormwater management</p> <p>project design completion date</p> <ul style="list-style-type: none"> <li>• project(NN):noun</li> <li>• design(NN):noun</li> <li>• completion(NNP)</li> <li>• date(NN): noun</li> </ul> <p>design completion delay due</p> <ul style="list-style-type: none"> <li>• design(NN):noun</li> <li>• completion(NNP)</li> <li>• date(NN): noun</li> <li>• due(VBD):verb</li> </ul> <p>Design Completion delayed due to Legal Street status</p> <p>due property acquisition process</p> <ul style="list-style-type: none"> <li>• due(VBD):verb</li> <li>• property(NN):noun</li> <li>• acquisition(NN):noun</li> <li>• process(NN):noun</li> </ul> <p>due acquisition process project</p> <ul style="list-style-type: none"> <li>• due(VBD):verb</li> <li>• acquisition(NN):noun</li> <li>• process(NN):noun</li> <li>• project(NN):noun</li> </ul>
<b>Bid</b> (Construction Procurement)	<p>basement ceiling abated architectural:</p> <ul style="list-style-type: none"> <li>• basement (NN): noun</li> <li>• ceiling (NN): noun</li> <li>• abated (VBD): verb</li> <li>• architectural (JJ): adjective</li> </ul> <p>ceiling abated architectural drawing:</p> <ul style="list-style-type: none"> <li>• ceiling (NN): noun</li> <li>• abated (VBD): verb, past tense</li> <li>• architectural (JJ): adjective</li> <li>• drawing (NN): noun</li> </ul> <p>ceiling abatement consultant revise:</p> <ul style="list-style-type: none"> <li>• ceiling (NN): noun</li> <li>• abatement (NN): noun</li> <li>• consultant (NN): noun</li> <li>• revise (VB): verb, base form</li> </ul> <p>ceiling include spot abatement:</p> <ul style="list-style-type: none"> <li>• ceiling (NN): noun</li> <li>• include (VB): verb, base form</li> <li>• spot (NN): noun</li> </ul>	<p>procurement delay due new</p> <ul style="list-style-type: none"> <li>• procurement(NN): noun</li> <li>• delay(NN):noun</li> <li>• due(JJ):adj</li> <li>• new(JJ):adj</li> </ul> <p>Rei procurement delay due to new system passport</p> <p>delay due new system</p> <ul style="list-style-type: none"> <li>• delay(NN):noun</li> <li>• due(JJ):adj</li> <li>• new(JJ):adj</li> <li>• system(NN):noun</li> </ul> <p>due new system passport</p> <ul style="list-style-type: none"> <li>• due(JJ):adj</li> <li>• new(JJ):adj</li> <li>• system(NN):noun</li> <li>• passport(NN):noun</li> </ul> <p>contract register ntp issue</p> <ul style="list-style-type: none"> <li>• contract(NN):noun</li> </ul>

	<ul style="list-style-type: none"> <li>• abatement (NN): noun</li> </ul> <p>happened fcb review awarded:</p> <ul style="list-style-type: none"> <li>• happened (VBD): verb, past tense</li> <li>• fcb (NN): noun</li> <li>• review (NN): noun</li> <li>• awarded (VBD): verb, past tense</li> </ul> <p>changed open bid bid:</p> <ul style="list-style-type: none"> <li>• changed (VBD): verb</li> <li>• open (JJ): adjective</li> <li>• bid (NN): noun</li> </ul> <p>client institution ddc manage:</p> <ul style="list-style-type: none"> <li>• client (NN): noun</li> <li>• institution (NN): noun</li> <li>• ddc (NNP): proper noun</li> <li>• manage (VBN): verb</li> </ul> <p>code drawing delaying consultant:</p> <ul style="list-style-type: none"> <li>• code (NN): noun</li> <li>• drawing (NN): noun</li> <li>• delaying (VBG): verb</li> <li>• consultant (NN): noun</li> </ul> <p>sent omb cp returned:</p> <ul style="list-style-type: none"> <li>• sent (VBD): verb, past tense</li> <li>• omb (NN): noun</li> <li>• cp (NN): noun</li> <li>• returned (VBD): verb</li> </ul> <p>securing additional funding needed:</p> <ul style="list-style-type: none"> <li>• securing (VBG): verb, gerund/present participle</li> <li>• additional (JJ): adjective</li> <li>• funding (NN): noun</li> <li>• needed (VBD): verb</li> </ul> <p>package revision consultant needed:</p> <ul style="list-style-type: none"> <li>• package (NN): noun</li> <li>• revision (NN): noun</li> <li>• consultant (NN): noun</li> <li>• needed (VBD): verb</li> </ul> <p>funding needed registration supplemental:</p> <ul style="list-style-type: none"> <li>• funding (NN): noun</li> <li>• needed (VBD): verb</li> <li>• registration (NN): noun</li> <li>• supplemental (JJ): adjective</li> </ul> <p>packaging unit caught legal:</p> <ul style="list-style-type: none"> <li>• packaging (NN): noun</li> <li>• unit (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>• register(VB):verb</li> </ul> <p>rei procurement delay due</p> <ul style="list-style-type: none"> <li>• rei(NNP):noun</li> <li>• procurement(NN): noun</li> <li>• dely(NN):noun</li> <li>• due(JJ):adj</li> </ul> <p>eo due diligence memo</p> <ul style="list-style-type: none"> <li>• eo(NN):noun</li> <li>• due(JJ):adj</li> <li>• diligence(NN):noun</li> <li>• memo(NN):noun</li> </ul> <p>bid open postpone due</p> <ul style="list-style-type: none"> <li>• bid(NN):noun</li> <li>• open(VB):verb</li> <li>• postpone(VB):verb</li> <li>• due(JJ):adj</li> </ul> <p>open postpone due omb</p> <ul style="list-style-type: none"> <li>• open(VB):verb</li> <li>• postpone(VB):verb</li> <li>• due(JJ):adj</li> <li>• omb(NN):noun</li> </ul> <p>postpone due omb pause</p> <ul style="list-style-type: none"> <li>• postpone(VB):verb</li> <li>• due(JJ):adj</li> <li>• omb(NN):noun</li> <li>• pause(NN):noun</li> </ul> <p>due omb pause outbreak</p> <ul style="list-style-type: none"> <li>• due(JJ):adj</li> <li>• omb(NN):noun</li> <li>• pause(NN):noun</li> <li>• outbreak(NN):noun</li> </ul> <p>revision buffer surface grade</p> <ul style="list-style-type: none"> <li>• revision(NN):noun</li> <li>• buffer(NN):noun</li> <li>• surface(NN):noun</li> <li>• grade(NN):noun</li> </ul> <p>buffer surface grade request</p> <ul style="list-style-type: none"> <li>• buffer(NN):noun</li> <li>• surface(NN):noun</li> <li>• grade(NN):noun</li> <li>• request(NN):noun</li> </ul> <p>surface grade request ddc</p> <ul style="list-style-type: none"> <li>• surface(NN):noun</li> <li>• grade(NN):noun</li> <li>• request(NN):noun</li> <li>• ddc(NNP):noun</li> </ul>
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	<ul style="list-style-type: none"> <li>• caught (VBD): verb</li> <li>• legal (JJ): adjective</li> </ul> <p>forgot two rfis latest:</p> <ul style="list-style-type: none"> <li>• forgot (VBD): verb, past tense</li> <li>• two (CD): cardinal number</li> <li>• rfis (NNS): noun, plural</li> <li>• latest (JJS): adjective</li> </ul> <p>consultant dga included electrical:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• dga (NN): noun</li> <li>• included (VBN): verb</li> <li>• electrical (JJ): adjective</li> </ul> <p>consultant needed time revision:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• needed (VBD): verb</li> <li>• time (NN): noun</li> <li>• revision (NN): noun</li> </ul> <p>consultant request update ada:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• request (NN): noun</li> <li>• update (NN): noun</li> <li>• ada (NN): noun</li> </ul> <p>consultant revise basement ceiling:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• revise (VB): verb</li> <li>• basement (NN): noun</li> <li>• ceiling (NN): noun</li> </ul> <p>consultant sub took long:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• sub (NN): noun</li> <li>• took (VBD): verb</li> <li>• long (JJ): adjective</li> </ul> <p>consultant submitting bid set:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• submitting (VBG): verb</li> <li>• bid (NN): noun</li> <li>• set (NN): noun</li> </ul> <p>consultant working area breakdown:</p> <ul style="list-style-type: none"> <li>• consultant (NN): noun</li> <li>• working (VBG): verb</li> <li>• area (NN): noun</li> <li>• breakdown (NN): noun</li> </ul> <p>rfis forgot two rfis:</p> <ul style="list-style-type: none"> <li>• rfis (NNS): noun, plural</li> <li>• forgot (VBD): verb</li> <li>• two (CD): cardinal number</li> </ul>	<p>grade request ddc public</p> <ul style="list-style-type: none"> <li>• grade(NN):noun</li> <li>• request(NN):noun</li> <li>• ddc(NNP):noun</li> <li>• public(JJ):adj</li> </ul> <p>request ddc public building</p> <ul style="list-style-type: none"> <li>• request(NN):noun</li> <li>• ddc(NNP):noun</li> <li>• public(JJ):adj</li> <li>• building(NN):noun</li> </ul> <p>bid opening move due</p> <ul style="list-style-type: none"> <li>• bid(NN):noun</li> <li>• opening(NN):noun</li> <li>• move(VB):verb</li> <li>• due(JJ):adj</li> </ul> <p>opening move due original</p> <ul style="list-style-type: none"> <li>• opening(NN):noun</li> <li>• move(VB):verb</li> <li>• due(JJ):adj</li> <li>• original(JJ):adj</li> </ul> <p>move due original bid</p> <ul style="list-style-type: none"> <li>• move(VB):verb</li> <li>• due(JJ):adj</li> <li>• original(JJ):adj</li> <li>• bid(NN):noun</li> </ul> <p>due original bid open</p> <ul style="list-style-type: none"> <li>• due(JJ):adj</li> <li>• original(JJ):adj</li> <li>• bid(NN):noun</li> <li>• open(NN):noun</li> </ul> <p>original bid open date</p> <ul style="list-style-type: none"> <li>• original(JJ):adj</li> <li>• bid(NN):noun</li> <li>• open(NN):noun</li> <li>• date(NN):noun</li> </ul> <p>bid open date major</p> <ul style="list-style-type: none"> <li>• bid(NN):noun</li> <li>• open(NN):noun</li> <li>• date(NN):noun</li> <li>• major(JJ):adj</li> </ul> <p>open date major holiday</p> <ul style="list-style-type: none"> <li>• open(NN):noun</li> <li>• date(NN):noun</li> <li>• major(JJ):adj</li> <li>• holiday(NN):noun</li> </ul> <p>date major holiday request</p>
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	<ul style="list-style-type: none"> <li>• rfis (NNS): noun, plural</li> </ul> revision consultant needed time: <ul style="list-style-type: none"> <li>• revision (NN): noun</li> <li>• consultant (NN): noun</li> <li>• needed (VBD): verb</li> <li>• time (NN): noun</li> </ul> revise basement ceiling include: <ul style="list-style-type: none"> <li>• revise (VB): verb</li> <li>• basement (NN): noun</li> <li>• ceiling (NN): noun</li> <li>• include (VB): verb</li> </ul> hold dcla private design: <ul style="list-style-type: none"> <li>• hold (VB): verb</li> <li>• dcla (NN): noun</li> <li>• private (JJ): adjective</li> <li>• design (NN): noun</li> </ul> hold due cp omb: <ul style="list-style-type: none"> <li>• hold (VB): verb</li> <li>• due (JJ): adjective</li> <li>• cp (NN): noun</li> <li>• omb (NN): noun</li> </ul> opening postponed time acco: <ul style="list-style-type: none"> <li>• opening (VBG): verb</li> <li>• postponed (VBD): verb, past tense</li> <li>• time (NN): noun</li> <li>• acco (NNP): proper noun</li> </ul> omb requested cp breakdown: <ul style="list-style-type: none"> <li>• omb (NN): noun</li> <li>• requested (VBD): verb, past tense</li> <li>• cp (NN): noun</li> <li>• breakdown (NN): noun</li> </ul> bid drawing bid packaging: <ul style="list-style-type: none"> <li>• bid (NN): noun</li> <li>• drawing (NN): noun</li> <li>• packaging (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>• date(NN):noun</li> <li>• major(JJ):adj</li> <li>• holiday(NN):noun</li> <li>• request(NN):noun</li> </ul> major holiday request potential <ul style="list-style-type: none"> <li>• major(JJ):adj</li> <li>• holiday(NN):noun</li> <li>• request(NN):noun</li> <li>• potential(JJ):adj</li> </ul> holiday request potential bidder <ul style="list-style-type: none"> <li>• holiday(NN):noun</li> <li>• request(NN):noun</li> <li>• potential(JJ):adj</li> <li>• bidder(NN):noun</li> </ul> bid opening date postpone <ul style="list-style-type: none"> <li>• bid(NN):noun</li> <li>• opening(NN):noun</li> <li>• date(NN):noun</li> <li>• postpone(NN):noun</li> </ul> opening date postpone due <ul style="list-style-type: none"> <li>• opening(NN):noun</li> <li>• date(NN):noun</li> <li>• postpone(NN):noun</li> <li>• due(JJ):adj</li> </ul> date postpone due mwbe <ul style="list-style-type: none"> <li>• date(NN):noun</li> <li>• postpone(NN):noun</li> <li>• due(JJ):adj</li> <li>• mwbe(NN):noun</li> </ul> postpone due mwbe issue <ul style="list-style-type: none"> <li>• postpone(NN):noun</li> <li>• due(JJ):adj</li> <li>• mwbe(NN):noun</li> <li>• issue(NN):noun</li> </ul> revise ntp issue utility <ul style="list-style-type: none"> <li>• revise(VB):verb</li> <li>• ntp(NN):noun</li> <li>• issue(NN):noun</li> <li>• utility(NN):noun</li> </ul>
<b>Build</b> (Construction and Closeout)	court decide install fire <ul style="list-style-type: none"> <li>• court (NNP): noun</li> <li>• decide (VBP): verb</li> <li>• install (JJ): other</li> <li>• fire (NN): noun</li> </ul> decide install fire alarm	facility direct interference propose <ul style="list-style-type: none"> <li>• facility(NN):noun</li> <li>• direct(JJ):adj</li> <li>• interference(NN):noun</li> <li>• propose(VB): verb</li> </ul> contractor stop work due

	<ul style="list-style-type: none"> <li>• decide (VBP): verb</li> <li>• install (JJ): other</li> <li>• fire (NN): noun</li> <li>• alarm (NN): noun</li> </ul> <p>install fire alarm device</p> <ul style="list-style-type: none"> <li>• install (JJ): other</li> <li>• fire (NN): noun</li> <li>• alarm (NN): noun</li> <li>• device (NN): noun</li> </ul> <p>fire alarm device courtroom</p> <ul style="list-style-type: none"> <li>• fire (NN): noun</li> <li>• alarm (NN): noun</li> <li>• device (NN): noun</li> <li>• courtroom (NN): noun</li> </ul> <p>alarm device courtroom lobby</p> <ul style="list-style-type: none"> <li>• alarm (NN): noun</li> <li>• device (NN): noun</li> <li>• courtroom (NN): noun</li> <li>• lobby (NN): noun</li> </ul> <p>device courtroom lobby affect</p> <ul style="list-style-type: none"> <li>• device (NN): noun</li> <li>• courtroom (NN): noun</li> <li>• lobby (NN): noun</li> <li>• affect (JJ): other</li> </ul> <p>courtroom lobby affect contractor</p> <ul style="list-style-type: none"> <li>• courtroom (NN): noun</li> <li>• lobby (NN): noun</li> <li>• affect (JJ): other</li> <li>• contractor (NN): noun</li> </ul> <p>lobby affect contractor planning</p> <ul style="list-style-type: none"> <li>• lobby (NN): noun</li> <li>• affect (JJ): other</li> <li>• contractor (NN): noun</li> <li>• planning (NN): noun</li> </ul> <p>affect contractor planning work</p> <ul style="list-style-type: none"> <li>• affect (JJ): other</li> <li>• contractor (NN): noun</li> <li>• planning (NN): noun</li> <li>• work (NN): noun</li> </ul> <p>Court did not decide if the will install fire alarm devices on courtroom and lobby which will affect the contractor planning for work.</p> <p>part approved time extension</p> <ul style="list-style-type: none"> <li>• part (NN): noun</li> <li>• approved (VBD): verb</li> </ul>	<ul style="list-style-type: none"> <li>• contractor(NNP):noun</li> <li>• stop(VB):verb</li> <li>• work(VB):verb</li> <li>• due(JJ):adj</li> </ul> <p>Due hpd funding shortage</p> <p>direct interference propose city</p> <ul style="list-style-type: none"> <li>• direct(JJ):adj</li> <li>• interference(NN):noun</li> <li>• propose(VB): verb</li> <li>• city(NN):noun</li> </ul> <p>stop work due hpd</p> <ul style="list-style-type: none"> <li>• stop (VB):verb</li> <li>• work(VB):verb</li> <li>• due(VB):verb</li> <li>• HPD(NNP):noun</li> </ul> <p>work due hpd funding</p> <ul style="list-style-type: none"> <li>• work(VB):verb</li> <li>• due(VBD):verb</li> <li>• HPD(NNP):noun</li> <li>• funding(NN):noun</li> </ul> <p>due hpd funding shortage</p> <ul style="list-style-type: none"> <li>• due(JJ):adj</li> <li>• HPD(NNP):noun</li> <li>• funding(NN):noun</li> <li>• shortage(NN):noun</li> </ul> <p>con edison electric facility</p> <ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• electric(NN):noun</li> <li>• facility(NN):noun</li> </ul> <p>due gas crossing electrical</p> <ul style="list-style-type: none"> <li>• due(VBD):verb</li> <li>• gas(NN):noun</li> <li>• crossing(VBD):verb</li> <li>• electrical(JJ):adj</li> </ul> <p>gas crossing electrical duct</p> <ul style="list-style-type: none"> <li>• gas(NN):noun</li> <li>• crossing(VBD):verb</li> <li>• electrical(JJ):adj</li> <li>• duct(NN):noun</li> </ul> <p>con edison facility direct</p> <ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• facility(NN):noun</li> <li>• direct (JJ): adj</li> </ul> <p>edison facility direct interference</p>
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	<ul style="list-style-type: none"> <li>• time (NNP): noun</li> <li>• extension (NNP): noun</li> </ul> <p>approved time extension approval</p> <ul style="list-style-type: none"> <li>• approved (VBD): verb</li> <li>• time (NNP): noun</li> <li>• extension (NNP): noun</li> <li>• approval (NN): noun</li> </ul> <p>Delay in EOR to Provide Sketch for RFI # 37 &amp; 39: A/EOR answered RFI 37 and 39 regarding existing sanitary, condensate and steam lines in the way of the fuel oil tank room but did not provide a sketch two months after the RFI was answered. The approved delays associated with this item are included in the approved Time Extension #1 approval.</p> <p>delay associated work included</p> <ul style="list-style-type: none"> <li>• delay (NN): noun</li> <li>• associated (VBN): verb</li> <li>• work (NN): noun</li> <li>• included (VBD): verb</li> </ul> <p>associated work included item</p> <ul style="list-style-type: none"> <li>• associated (VBN): verb</li> <li>• work (NN): noun</li> <li>• included (VBD): verb</li> <li>• item (NNP): noun</li> </ul> <p>work included item part</p> <ul style="list-style-type: none"> <li>• work (NN): noun</li> <li>• included (VBD): verb</li> <li>• item (NNP): noun</li> <li>• part (NN): noun</li> </ul> <p>included item part approved</p> <ul style="list-style-type: none"> <li>• included (VBD): verb</li> <li>• item (NNP): noun</li> <li>• part (NN): noun</li> <li>• approved (VBD): verb</li> </ul> <p>item part approved time</p> <ul style="list-style-type: none"> <li>• item (NNP): noun</li> <li>• part (NN): noun</li> <li>• approved (VBD): verb</li> <li>• time (NNP): noun</li> </ul> <p>Staging area usage by DHS; West courtyard was taken over by DHS for parking. Contractually this area is designated as construction staging area</p>	<ul style="list-style-type: none"> <li>• con-edison(NNP): noun</li> <li>• facility(NN):noun</li> <li>• direct (JJ): adj</li> <li>• interference(NN):noun</li> </ul> <p>new gas main instal</p> <ul style="list-style-type: none"> <li>• new(JJ):adj</li> <li>• gas(NN):noun</li> <li>• main(NN):noun</li> <li>• instal(VBD):verb</li> </ul> <p>ave due gas crossing</p> <ul style="list-style-type: none"> <li>• Ave (NNP):noun</li> <li>• due(VBD):verb</li> <li>• gas(NN):noun</li> <li>• crossing(VBG):verb</li> </ul> <p>1st to 44th Street b/n 1 Ave to 4 Ave due to gas crossing and electrical ducts.</p> <p>gas main currently direct</p> <ul style="list-style-type: none"> <li>• gas(NN):noun</li> <li>• main(NN):noun</li> <li>• currently(RB): adv</li> <li>• Direct (JJ) adj</li> </ul> <p>The gas mains are currently in direct interference with the new sewer layout.</p> <p>catch basin chute connection</p> <ul style="list-style-type: none"> <li>• catch(VBD):verb</li> <li>• basin(NN):noun</li> <li>• chute (NN):noun</li> <li>• connection(NN):noun</li> </ul> <p>electric facility direct interference</p> <ul style="list-style-type: none"> <li>• electric(JJ):adj</li> <li>• facility(NN):noun</li> <li>• direct(JJ):adj</li> <li>• interference(NN):noun</li> </ul> <p>con edison utility interference</p> <ul style="list-style-type: none"> <li>• con-edison(NNP):Noun</li> <li>• utility(NN):noun</li> <li>• interference(NN):noun</li> </ul> <p>interference propose city dwm</p> <ul style="list-style-type: none"> <li>• direct(JJ):adj</li> <li>• interference(NN):noun</li> <li>• propose(VBD): verb</li> <li>• DWM(NNP):noun</li> </ul>
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	<p>and allowing general public access for parking creates various liability issues. NSP has claimed delay regarding access to the construction staging area. The approved delays associated with this work are included with Item #7 and are part of the approved Time Extension #1 approval.</p> <p>shaft work ccds LPC</p> <ul style="list-style-type: none"> <li>• shaft (NNP): noun</li> <li>• work (NN): noun</li> <li>• ccds (NN): noun</li> <li>• LPC (NNP): noun</li> </ul> <p>expose existing deteriorated collapsed</p> <ul style="list-style-type: none"> <li>• expose (VBD): verb</li> <li>• existing (VBG): verb</li> <li>• deteriorated (VBN): verb</li> <li>• collapsed (JJ): other</li> </ul> <p>Dorm 1- Excavate to expose existing deteriorated and collapsed sewer mains. This additional work was needed to complete the original scope.</p> <p>existing deteriorated collapsed sewer</p> <ul style="list-style-type: none"> <li>• existing (VBG): verb</li> <li>• deteriorated (VBN): verb</li> <li>• collapsed (JJ): other</li> <li>• sewer (NN): noun</li> </ul> <p>deteriorated collapsed sewer main</p> <ul style="list-style-type: none"> <li>• deteriorated (VBN): verb</li> <li>• collapsed (JJ): other</li> <li>• sewer (NN): noun</li> <li>• main (JJ): other</li> </ul> <p>Dorm 1 - Excavate to expose existing deteriorated and collapsed sewer mains. This additional work was needed to complete the original scope.</p> <p>approved delay associated work</p> <ul style="list-style-type: none"> <li>• approved (VBD): verb</li> <li>• delay (NN): noun</li> <li>• associated (VBN): verb</li> <li>• work (NN): noun</li> </ul> <p>fund ca phase loring</p> <ul style="list-style-type: none"> <li>• fund (NN): noun</li> <li>• ca (NNP): noun</li> <li>• phase (NN): noun</li> <li>• loring (NNP): noun</li> </ul>	<p>Con Edison Electric and Gas facilities in direct interference with proposed City 12-in DWM</p> <p>edison electric facility direct</p> <ul style="list-style-type: none"> <li>• con-edison(NNP):noun</li> <li>• electric(JJ):adj</li> <li>• facility(NN):noun</li> <li>• direct(JJ):adj</li> </ul> <p>con edison DDC issue</p> <ul style="list-style-type: none"> <li>• con-edison(NNP):noun</li> <li>• DDC(NNP):noun</li> <li>• issue(NN):noun</li> </ul> <p>Con Edison and DDC has issued excavation safety alert</p> <p>edison ddc issue excavation</p> <ul style="list-style-type: none"> <li>• con-edison(NNP):noun</li> <li>• DDC(NNP):noun</li> <li>• issue(NN):noun</li> <li>• Excavation (NN):noun</li> </ul> <p>ddc issue excavation safety</p> <ul style="list-style-type: none"> <li>• DDC(NNP):noun</li> <li>• issue(NN):noun</li> <li>• Excavation (NN):noun</li> <li>• Safety (NN):noun</li> </ul> <p>issue excavation safety alert</p> <ul style="list-style-type: none"> <li>• issue(NN):noun</li> <li>• Excavation (NN):noun</li> <li>• Safety (NN):noun</li> <li>• alert(NN):NOUN</li> </ul> <p>notice condition cause delay</p> <ul style="list-style-type: none"> <li>• notice(VBD):verb</li> <li>• condition(NN):noun</li> <li>• cause(VBD):verb</li> <li>• delay(VBD):verb</li> </ul> <p>DDC notice causing delay</p> <p>contractor schedule support con</p> <ul style="list-style-type: none"> <li>• contractor(NNP):noun</li> <li>• schedule(VBD):verb</li> <li>• support(VBD):verb</li> <li>• con-edison(NNP):noun</li> </ul> <p>work perform outside section</p> <ul style="list-style-type: none"> <li>• work(NN):noun</li> <li>• perform(VBD):verb</li> <li>• outside(JJ) adj</li> <li>• section(NN):non</li> </ul>
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	<p>Now their contract with LiRo has ended for CD phase and they are requesting additional funds for CA phase.</p> <p>work ccds LPC approved</p> <ul style="list-style-type: none"> <li>• work (NN): noun</li> <li>• ccds (NN): noun</li> <li>• LPC (NNP): noun</li> <li>• approved (NNP): noun</li> </ul> <p>ccds LPC approved change</p> <ul style="list-style-type: none"> <li>• ccds (NN): noun</li> <li>• LPC (NNP): noun</li> <li>• approved (NNP): noun</li> <li>• change (NN): noun</li> </ul> <p>LPC approved change space</p> <ul style="list-style-type: none"> <li>• LPC (NNP): noun</li> <li>• approved (NNP): noun</li> <li>• change (NN): noun</li> <li>• space (NN): noun</li> </ul> <p>approved change space design</p> <ul style="list-style-type: none"> <li>• approved (NNP): noun</li> <li>• change (NN): noun</li> <li>• space (NN): noun</li> <li>• design (NN): noun</li> </ul> <p>change space design reconfiguration</p> <ul style="list-style-type: none"> <li>• change (NN): noun</li> <li>• space (NN): noun</li> <li>• design (NN): noun</li> <li>• reconfiguration (NN): noun</li> </ul> <p>space design reconfiguration ccds</p> <ul style="list-style-type: none"> <li>• space (NN): noun</li> <li>• design (NN): noun</li> <li>• reconfiguration (NN): noun</li> <li>• ccds (NN): noun</li> </ul> <p>Shaft A work – 22% - 22.00 ccds. LPC Approved changes – space designs reconfiguration. 55% 55.00 ccds.</p> <p>extended closeout period corrected</p> <ul style="list-style-type: none"> <li>• extended (VBN): verb</li> <li>• closeout (NNP): noun</li> <li>• period (NN): noun</li> <li>• corrected (VBD): verb</li> </ul> <p>closeout period corrected schedule</p> <ul style="list-style-type: none"> <li>• closeout (NNP): noun</li> <li>• period (NN): noun</li> <li>• corrected (VBD): verb</li> <li>• schedule (NN): noun</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul> <p>religious holiday per councilman</p> <ul style="list-style-type: none"> <li>• religious(JJ):adj</li> <li>• holiday(NN):noun</li> <li>• councilman(NN) : noun</li> </ul> <p>Religious Holiday - As per Councilman Deutsch Request</p>
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	extended closeout period and corrected schedule	
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### **Key Findings:**

- Some keywords may be referencing acronyms so need to clarify those to further dig into these keywords as well.
- Delays can also be related to more straightforward reasons, as some roadmapped tasks can take longer than initially anticipated.
- Delay causes also vary by each division during each phase.

### **Public Building Division:**

- Design Phase:
  - In the design phase, delays are mainly due to delay in approval requests including delayed in FDNY approval, bid packaging review, rejection of certified to proceed request. There are new delay causes that appear in top 30 in POS, which are 'Obra's D and DD submission were found unsatisfactory and pushed back the schedule'. Some delays caused in top 30 by Bag-of-Words approach that don't appear in top 30 using POS are change and update rule requirement (MWBE), and add-in design requested by DOT.
- Bid Phase:
  - A lot of the delays in the "Bid" phase for Public Buildings are related to the Certificate to Process. Is this a residual effect from issues with the CP during the "Design" phase?
  - A lot of the delays in the "Bid" phase for Public Buildings seem to be attributed to consultants either requesting additional information or needing to complete additional work.
- Build Phase:
  - Many delays are approved through time extension requests. They are related to RFI, DHS, accidental leak, space designs reconfiguration, etc.
  - From many projects, it can be found that the installation, absence, or inspection of fire alarm systems has a significant impact on work schedule.

- Other delays are related to additional work caused by pipeline aging, rescheduled construction start date, the application for additional funding for the new phase of the contract, and the extended closeout period and corrected schedule.

### **Infrastructure Division:**

- Design Phase:
  - A lot of delays seem to be related to the project being transferred to another fiscal year.
  - Other delays are related to legacy projects, the receipt of the draft CPI, procurement delay, moving by the sponsor agency, rebid, acquisition process, technical issues such as passport, etc.
- Bid Phase:
  - A lot of delays seem to be related to the project being transferred to another fiscal year.
  - Many delays might be caused by technical issues with the new PASSport Procurement System.
  - Some delays are related to the opening of bids and the bidding process, like “bid open postpone.”
- Build Phase:
  - A lot of delays seem to be related to some direct interference to the construction.
  - There are many infrastructure delays in Con Edison, which indicates that energy-related projects may often experience construction delays.
  - Many contractors stop working due to various funding shortages.

### **Key Differences:**

- Design Phase:
  - The main cause of delay in public buildings related to fire prevention and fire safety (FDNY) approval, design initial cp request and sponsor agency delay. Procurement. Problems in procurement are more likely to occur in the public building division, such as staff shortage in the DDC procurement team.

- On the other hand, delays in infrastructure are mainly due to legacy projects or Pre-front end planning which probably needs to be revised, scope change by sponsor agency, and incomplete scope change, one highlighted example is Bioswales to Porous pavement.
- Bid Phase:
  - Public Buildings has more delays related to the Certificates to Proceed and consultants than Infrastructure.
- Build Phase:
  - Comparing the two divisions, delays in Public Buildings are more related to some necessary facilities such as fire alarm systems and pipelines, which aligns with the construction process of public buildings, while those in Infrastructure are more related to some unavoidable interference because many of them are energy-related.

### **Key Similarities:**

- Design Phase:
  - Both Public Buildings and Infrastructure face delays due to design add-in requests and policy/requirements revision and update.
- Bid Phase:
  - OMB (Office of Management and Budget) appears in several keywords.
  - CP is mentioned a few times in Infrastructure, but appears more frequently in Public Buildings.
- Build Phase:
  - Both Public Buildings and Infrastructure have delays caused by the schedule of contractors being affected.

## **8. Tableau Clustering Analysis**

### **8.1 Public Building**

#### **Original Data - Design Phase**

## Public Buildings Design Clustering



- Cluster 1: 182 projects
  - Moderate values across all risk subcategories.
  - “1.01 Scope Changes,” “1.02 Lack of Definition,” and “2.01 Delay by Vendor” are notable but not extreme.
- Cluster 2: 24 projects
  - Higher values for “2.02 Delay by External Stakeholder” and “5.02 Standard Procedures.”
- Cluster 2 likely includes projects with more complex external stakeholder interactions or procedural complications.
  - The projects within this cluster relate to DCAS Court Facility, Transportation DOT Facility, Brooklyn Public Library Facility, Queens Public Library Facility, and Cultural Affairs Cultural Facility.

## Original Data - Bid Phase

### Public Buildings Bid Clustering



- Cluster 1: 50 projects
  - Higher presence of “3.01 Funding” and “6.03 Procurement Management.”
  - Moderate occurrences of “2.02 Delay by External Stakeholder” and “6.04 Property Acquisition.”



- Cluster 2: 40 projects
  - Significant occurrences of “6.04 Property Acquisition” and “8.01 Market Conditions.”
  - Moderate occurrences of “9.05 Health and Safety” and “9.07 Surrounding Structures.”
- Cluster 3: 2 projects
  - Very high occurrences for “1.01 Scope Changes.”
- Cluster 2 includes projects with significant property acquisition and market conditions concerns, indicating a focus on real estate and economic factors.
  - The projects within this cluster are related to DCAS Court Facility, Homeless Services Homeless-Related Facility, Health-Related Facility, Brooklyn Public Library Facility, New York Public Library Facility, Queens Public Library Facility, Police Public Safety-Related Facility, Cultural Affairs Cultural Facility, DCAS Court Facility, DCAS City-Owned Building Project, Environmental Protection DEP Facility, Sanitation Facility.

## Original Data - Build Phase

### Public Buildings Build Clustering



- Cluster 1: 243 projects
  - High presence of “4.01 Design Error,” “4.03 Construction Quality,” and “6.03 Procurement Management.”
  - Moderate occurrences of “1.01 Scope Changes,” “2.01 Delay by Vendor,” and “7.02 Oversight.”
- Cluster 2: 23 projects

- Significant occurrences of “2.01 Delay by Vendor,” “2.02 Delay by External Stakeholder,” “5.02 Standard Procedures,” and “1.02 Lack of Definition,” “6.03 Procurement Management,” and “8.01 Market Conditions,”
- Cluster 3: 6 projects
  - Significant presence of “4.03 Construction Quality,” “9.07 Surrounding Structures.”
  - Moderate occurrences of “3.01 Funding” and “8.01 Market Conditions.”
- Cluster 2 includes projects with significant delays by vendors and external stakeholders.
  - The projects within this cluster relate to DCAS Court Facility, Health-Related Facility, Brooklyn Public Library Facility, New York Public Library Facility, Queens Public Library Facility, Cultural Affairs Cultural Facility, Sanitation Facility.

## BOW Coded Data - Design Phase

### Public Buildings Design Clustering

DDCProject31 DDCProject35 DDCProject42 DDCProject45 DDCProject54 DDCProject137 DDCProject138 DDCProject146 DDCProject162  
 DDCProject163 DDCProject164 DDCProject317 DDCProject351 DDCProject357 DDCProject381 DDCProject386 DDCProject391 DDCProject427  
 DDCProject428 DDCProject444 DDCProject446 DDCProject459 DDCProject476 DDCProject482 DDCProject524 DDCProject526 DDCProject528  
 DDCProject529 DDCProject530 DDCProject564 DDCProject664 DDCProject668 DDCProject675 DDCProject757 DDCProject142 DDCProject144  
 DDCProject154 DDCProject380 DDCProject422

Clusters  
 ■ Cluster 1  
 ■ Cluster 2

- Cluster 1: 34 projects
  - High values for “1.01 Scope Changes,” “1.02 Lack of definition,” “2.02 Delay by External Stakeholder,” “2.99 Other,” “4.99 Other,” “5.02 Standard Procedures,” and “6.03 Procurement Management.”
- Cluster 2: 5 projects
  - High values for “1.02 Lack of definition,” “2.02 Delay by External Stakeholder,” “6.03 Procurement Management.”
- Cluster 2 project relate to Brooklyn Public Library Facility and New York Public Library Facility
  - The projects within this cluster are related to Brooklyn Public Library Facility and New York Public Library Facility.

## BOW Coded Data - Bid Phase

### Public Buildings Bid Clustering

DDCProject114 DDCProject175 DDCProject382 DDCProject383 DDCProject428 DDCProject375 DDCProject550

Clusters  
 ■ Cluster 1  
 ■ Cluster 2  
 ■ Cluster 3

- Cluster 1: 5 projects
  - High values for “6.03 Procurement Management,” “2.02 Delay by External Stakeholder,” “3.01 Funding,” “2.01 Delay by Vendor.”



- Cluster 2: 1 project
  - High values of “6.03 Procurement Management,” “2.02 Delay by External Stakeholder,” “3.01 Funding,” “6.04 Property Acquisition.”
- Cluster 3: 1 project
  - High values of "6.03 Procurement Management," “2.01 Delay by Vendor,” "2.02 Delay by External Stakeholder," “3.01 Funding,” "4.01 Design Error," and "4.03 Construction Quality
- Cluster 1 projects relate to Brooklyn Public Library Facility and New York Public Library Facility.

## BOW Coded Data - Build Phase

### Public Building Build Clustering

DDCProject19 DDCProject20 DDCProject22 DDCProject130 DDCProject134  
 DDCProject156 DDCProject177 DDCProject347 DDCProject350 DDCProject365  
 DDCProject371 DDCProject436 DDCProject457 DDCProject461 DDCProject466  
 DDCProject507 DDCProject582 DDCProject661 DDCProject668 DDCProject21  
 DDCProject92 DDCProject139 DDCProject475 DDCProject593 DDCProject663  
 DDCProject672 DDCProject27

#### Clusters

- Cluster 1
- Cluster 2
- Cluster 3

- Cluster 1: 20 projects
  - High values for “2.02 Delay by External Stakeholder,” “6.02 Change Order Management,” "6.03 Procurement Management," “9.01 Environmental Conditions,” “9.02 Private Utilities,” “9.03 Subsurface Field Conditions,” and “9.04 Above Grade Field Condition.”
- Cluster 2: 7 projects
  - High values for “1.02 Lack of definition” and “2.02 Delay by External Stakeholder.”
- Cluster 3: 1 project
  - High values for “2.99 Other,” “2.02 Delay by External Stakeholder,” “2.01 Delay by Vendor,” “1.02 Lack of Definition,” and “4.04 Schedule Quality.”
- Cluster 3 contains a value of 99.0 for variable “1.02 Lack of Definition.”
  - Projects in this cluster are related to Court Facility

## 8.2 Infrastructure

### Original Data - Design Phase

## Infrastructure Design Clusters

DDCProject15	DDCProject56	DDCProject98	DDCProject105	DDCProject106	DDCProject107	DDCProject108	DDCProject110	Clusters
DDCProject111	DDCProject120	DDCProject186	DDCProject188	DDCProject197	DDCProject201	DDCProject207	DDCProject209	
DDCProject216	DDCProject218	DDCProject222	DDCProject225	DDCProject227	DDCProject228	DDCProject231	DDCProject234	Cluster 1
DDCProject235	DDCProject240	DDCProject241	DDCProject242	DDCProject244	DDCProject245	DDCProject246	DDCProject248	Cluster 2
DDCProject249	DDCProject258	DDCProject264	DDCProject265	DDCProject266	DDCProject267	DDCProject272	DDCProject276	
DDCProject282	DDCProject292	DDCProject293	DDCProject294	DDCProject295	DDCProject296	DDCProject321	DDCProject327	
DDCProject328	DDCProject329	DDCProject504	DDCProject515	DDCProject531	DDCProject673	DDCProject687	DDCProject689	
DDCProject693	DDCProject716	DDCProject734	DDCProject8	DDCProject9	DDCProject11	DDCProject12	DDCProject14	
DDCProject16	DDCProject17	DDCProject18	DDCProject58	DDCProject60	DDCProject61	DDCProject83	DDCProject84	
DDCProject85	DDCProject86	DDCProject87	DDCProject88	DDCProject89	DDCProject90	DDCProject91	DDCProject103	
DDCProject109	DDCProject119	DDCProject121	DDCProject124	DDCProject184	DDCProject185	DDCProject187	DDCProject189	
DDCProject190	DDCProject192	DDCProject193	DDCProject198	DDCProject200	DDCProject203	DDCProject204	DDCProject205	
DDCProject208	DDCProject212	DDCProject213	DDCProject215	DDCProject217	DDCProject223	DDCProject224	DDCProject226	
DDCProject233	DDCProject239	DDCProject243	DDCProject263	DDCProject271	DDCProject273	DDCProject274	DDCProject275	
DDCProject277	DDCProject278	DDCProject280	DDCProject281	DDCProject283	DDCProject285	DDCProject286	DDCProject288	
DDCProject289	DDCProject290	DDCProject291	DDCProject297	DDCProject298	DDCProject299	DDCProject300	DDCProject301	
DDCProject302	DDCProject307	DDCProject308	DDCProject309	DDCProject310	DDCProject311	DDCProject312	DDCProject314	
DDCProject315	DDCProject316	DDCProject320	DDCProject330	DDCProject331	DDCProject332	DDCProject333	DDCProject334	
DDCProject335	DDCProject340	DDCProject341	DDCProject342	DDCProject343	DDCProject344	DDCProject486	DDCProject491	
DDCProject495	DDCProject499	DDCProject643	DDCProject654	DDCProject657	DDCProject659	DDCProject660	DDCProject671	
DDCProject674	DDCProject684	DDCProject685	DDCProject692	DDCProject696	DDCProject697	DDCProject702	DDCProject703	
DDCProject708	DDCProject709	DDCProject710	DDCProject711	DDCProject712	DDCProject713	DDCProject714	DDCProject715	
DDCProject717	DDCProject719	DDCProject720	DDCProject721	DDCProject723	DDCProject724	DDCProject725	DDCProject731	
DDCProject732	DDCProject735	DDCProject736	DDCProject737	DDCProject738	DDCProject740	DDCProject741	DDCProject742	
DDCProject743	DDCProject745	DDCProject746	DDCProject747	DDCProject748	DDCProject749	DDCProject750	DDCProject751	
DDCProject752	DDCProject753	DDCProject754	DDCProject759					

- Cluster 1: 145 projects
  - High values for “1.01 Scope Changes,” “6.03 Procurement Management,” and “2.99 Others.”
- Cluster 2: 59 projects
  - Moderate to high values for “8.02 Public health Emergency,” assuming are projects related with covid-19
- Cluster 2 shows a concern for "8.02 Public Health Emergency"
  - The projects within this cluster relate to Brooklyn Trunk Water Main, Brooklyn Sanitary Sewer Reconstruction, S. Queens Green Infra Program (GI), Brooklyn Green Infra Program (GI), Manhattan & Citywide Intersection Improvement, Brooklyn Pedestrian Safety, S. Queens School Safety Program, Brooklyn Select Bus Service Impr., Brooklyn Roadway Reconstruction, Brooklyn Streetscape, Brooklyn Vision Zero, Manhattan & Citywide Roadway Reconstruction, Brooklyn Pedestrian Ramp Upgrade- Simple/Complex, S. Queens Pedestrian Ramp Upgrade- Simple/Complex, Manhattan and Citywide Pedestrian Ramps Install - Simple/Complex, Brooklyn Plazas, S. Queens Select Bus Service Impr., Brooklyn Sidewalk Maintenance, Brooklyn Trench restoration, S. Queens Trench restoration, Manhattan & Citywide Bulkheads & Outfalls, Manhattan & Citywide Storm Sewer Reconstruction, Brooklyn Streetscape, Brooklyn Combined Sewers, S. Queens New Storm Sewers.

## Original Data - Bid Phase

## Infrastructure Bid Clustering



- Cluster 1: 119 projects
  - High values for “2.02 Delay by External Stakeholder.”
- Cluster 2: 27 projects
  - Moderate to high values for “6.03 Procurement Management.”
- Cluster 2 displays a variety of issues including delays, financial constraints and difficulties. The projects grouped in this cluster are associated with several types of facilities: Brooklyn Trunk Water Main, Brooklyn Distribution Water main, Brooklyn Green Infra Program (GI), Brooklyn Vision Zero, Brooklyn Roadway Reconstruction, Manhattan & Citywide Roadway Reconstruction, Brooklyn Pedestrian Ramp Upgrade-Simple/Complex, Brooklyn Sidewalk Maintenance, Manhattan & Citywide Distribution Water main, Manhattan & Citywide Roadway Reconstruction, Brooklyn Combined Sewers, Brooklyn Lining, Staten Island Sewer, Staten Island New Storm Sewers, Manhattan & Citywide TV Inspection of Sewer.

## Original Data - Build Phase

### Infrastructure Build Clustering



- Cluster 1: 119 projects
  - High values for “9.02 Private Utilities” and “9.03 Subsurface Field Conditions.”

- Cluster 2: 6 projects
  - High values for “9.02 Private Utilities” and “9.99 Others”
- Cluster 2 has the highest overall risk profile, with projects showing higher levels of risk
  - The projects within this cluster relate to the Brooklyn Distribution Water main, Manhattan & Citywide Pedestrian Safety, Manhattan & Citywide Distribution Water main, Brooklyn Combined Sewers.

## BOW Coded Data - Design Phase

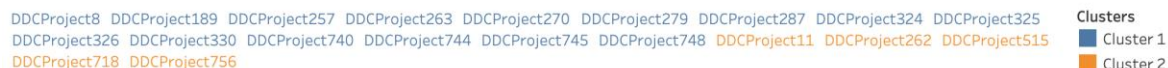
### Infrastructure Design Clustering



- Cluster 1: 18 projects
  - High values for “2.99 Others,” “1.99 Others”
- Cluster 2: 52 projects
  - Moderate to high values for “3.01 Funding,” “3.03 Others,” “1.01 Scope Changes” and “2.02 Delay by External Stakeholder.”
- Cluster 1 has the highest overall risk profile, with projects showing higher levels of risk
  - The projects within this cluster relate to the Brooklyn Trunk Water Main, Brooklyn Distribution Water main, Brooklyn Sanitary Sewer Reconstruction, Brooklyn Storm Sewer Reconstruction, Brooklyn Vision Zero, Brooklyn Pedestrian Safety, Brooklyn Streetscape, Brooklyn Combined Sewers, Brooklyn New Storm Sewers.

## BOW Coded Data - Bid Phase

### Infrastructure Bid Clustering



- Cluster 1: 15 projects



- High values for “6.03 Procurement Management,” “2.02 Delay by External Stakeholder.”
- Moderate occurrences are “3.01 Funding,” “1.02 Lack of Definition,” and “1.01 Scope Changes.”
- Cluster 2: 5 projects
  - Notable presence of “6.03 Procurement Management.”
  - High values for “2.02 Delay by External Stakeholder” and “2.01 Delay by Vendor.”
  - Moderate occurrence for “7.01 Communication.”
- Cluster 2 displays a variety of issues including delays, financial constraints, and difficulties. The projects grouped in this cluster are associated with several types of facilities: Brooklyn Trunk Water Main, Brooklyn Pedestrian Ramp Upgrade-Simple/Complex, Brooklyn Bulkheads & Outfalls, Brooklyn Combined Sewers, Manhattan & Citywide TV Inspection of Sewer.

## BOW Coded Data - Build Phase

### Infrastructure Build Clustering



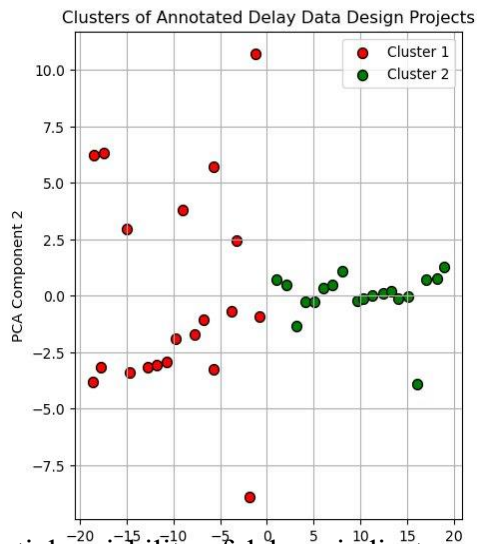
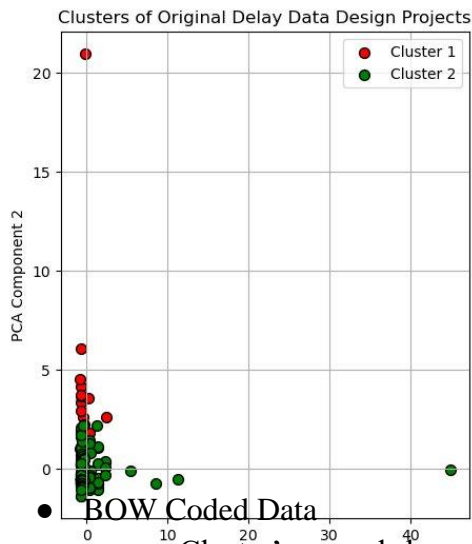
- Cluster 1: 3 projects
  - Notable presence of “2.01 Delay by Vendor” and “4.04 Schedule Quality.”
  - Moderate values for “9.02 Private Utilities.”
- Cluster 2: 37 project
  - High values for “9.02 Private Utilities.”
- Cluster 3: 2 projects
  - Notable presence of “2.01 Delay by Vendor,” “2.02 Delay by External Stakeholder,” and “3.01 Funding.”
- Cluster 4: 2 projects
  - High presence of “9.02 Private Utilities.”
- Cluster 5: 1 project
  - High presence of “9.02 Private Utilities.”
  - Moderate values for “9.03 Subsurface Field Conditions”
- Cluster 5 has the highest overall risk profile, with projects showing higher levels of risk

- The projects within this cluster relate to the Brooklyn Distribution Water Main.

## 9. K-Means Clustering

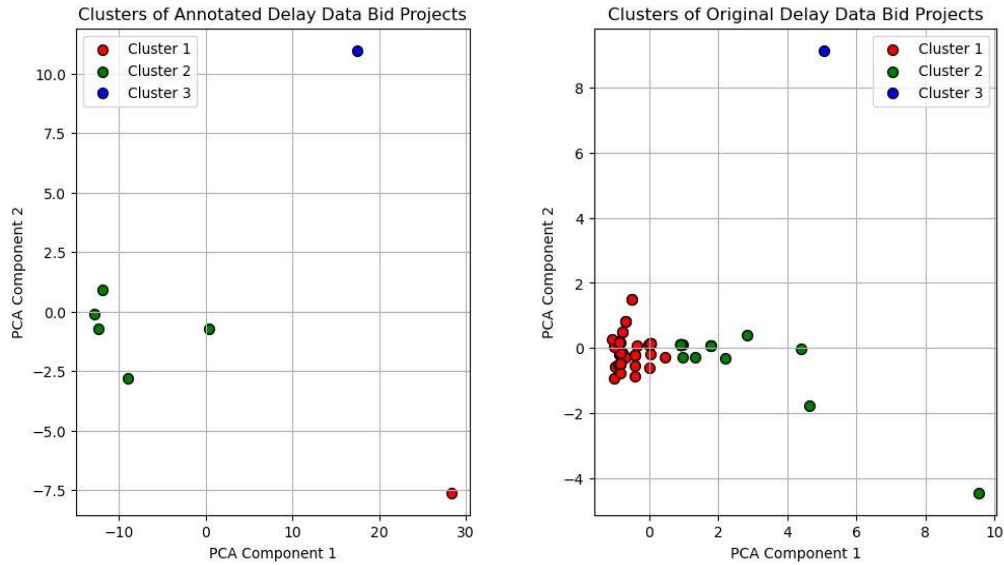
### 9.1 Public Buildings

#### Design



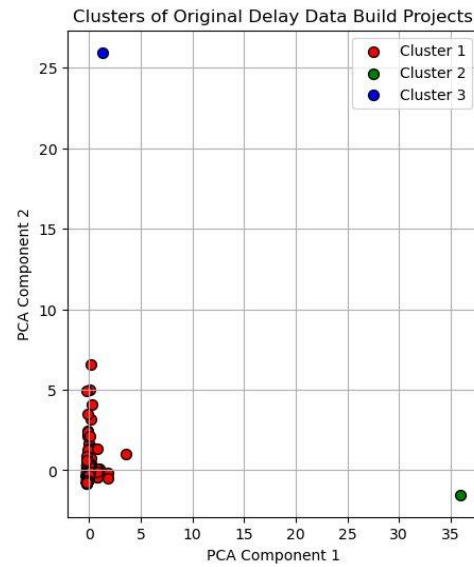
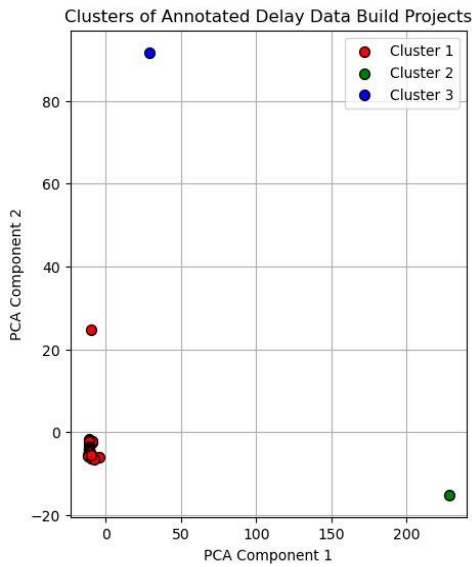
- BOW Coded Data
  - Cluster's spread shows more potential variability of delays, indicate more detailed or different tagging of delay aspects, which could be useful for refining delay mitigation strategies.
- Original Data:
  - Cluster 1 major delay subcategory: "1.01 Scope Changes."
  - Cluster 2 major delay subcategory: "8.02 Public Health Emergency."
  - Majority of projects in cluster 1 faced delay due to scope changes; projects in cluster 2 faced delay issues from external environmental factors.

#### Bid



- BOW Coded Data
  - Clusters show a greater spread and isolation between clusters, indicating more distinct variability among the BOW coded projects.
  
- Original Data
  - Cluster 1 major delay subcategory: “8.02 Public Health Emergency.”
  - Cluster 2 major delay subcategory: “6.03 Procurement Management.”
  - Cluster 3 major delay subcategory: “2.01 Delay by Vendor.”
  - Majority of delays are related to the external environment, particularly public health emergency.

## Build

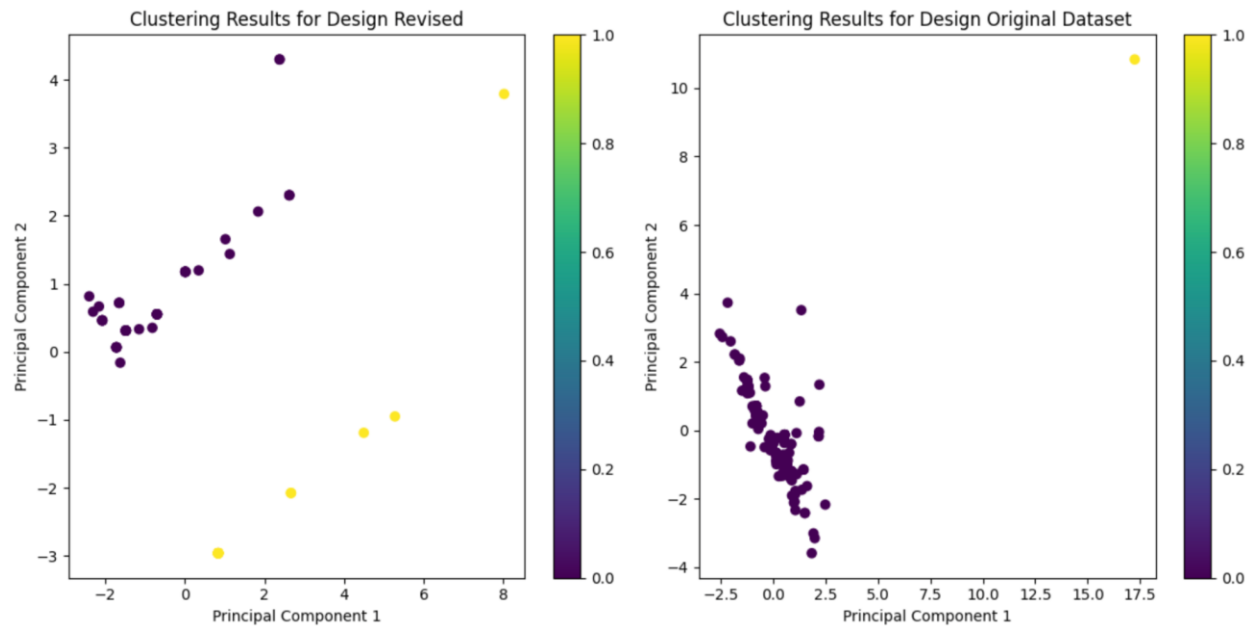


- BOW Coded Data
  - Clusters show more pronounced dispersion along the axes, suggesting that the annotation process may have identified unique characteristics that the original data's PCA did not capture as distinctly.
  
- Original Data
  - Cluster 1 major delay subcategory: “8.02 Public Health Emergency.”
  - Cluster 2 major delay subcategory: “9.01 Environmental Conditions.”
  - Cluster 3 major delay subcategory: “7.01 Communication.”
  - Leading delay issue in the majority of these projects is due to public health emergency.

## 9.2 Infrastructure

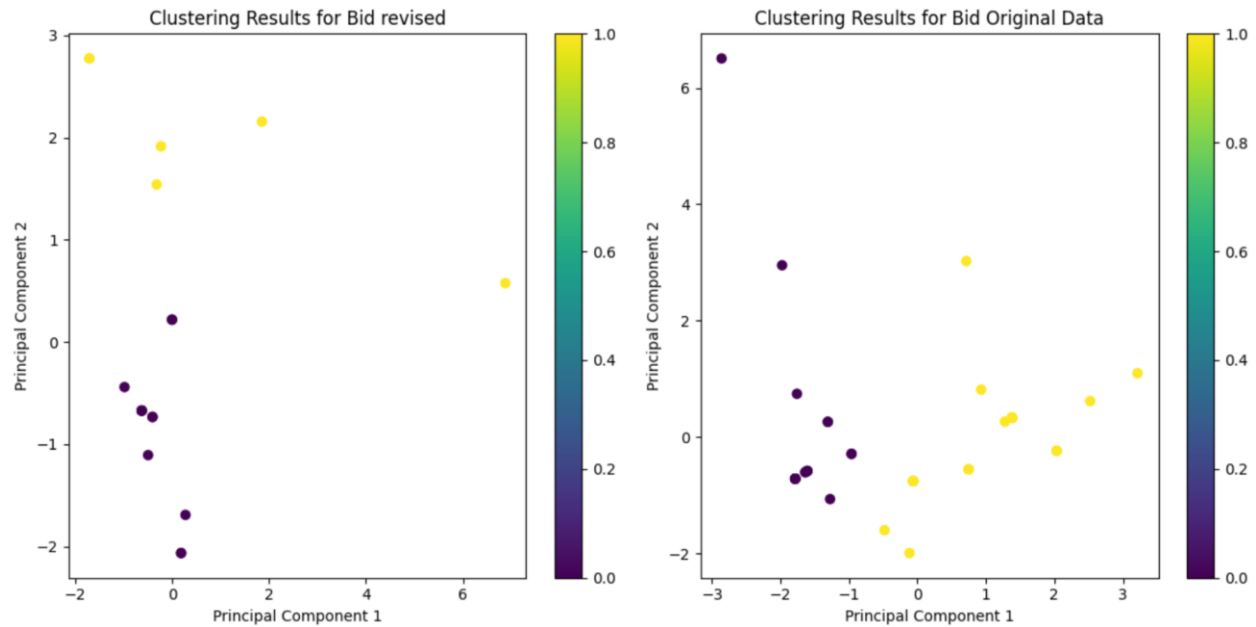
### Design





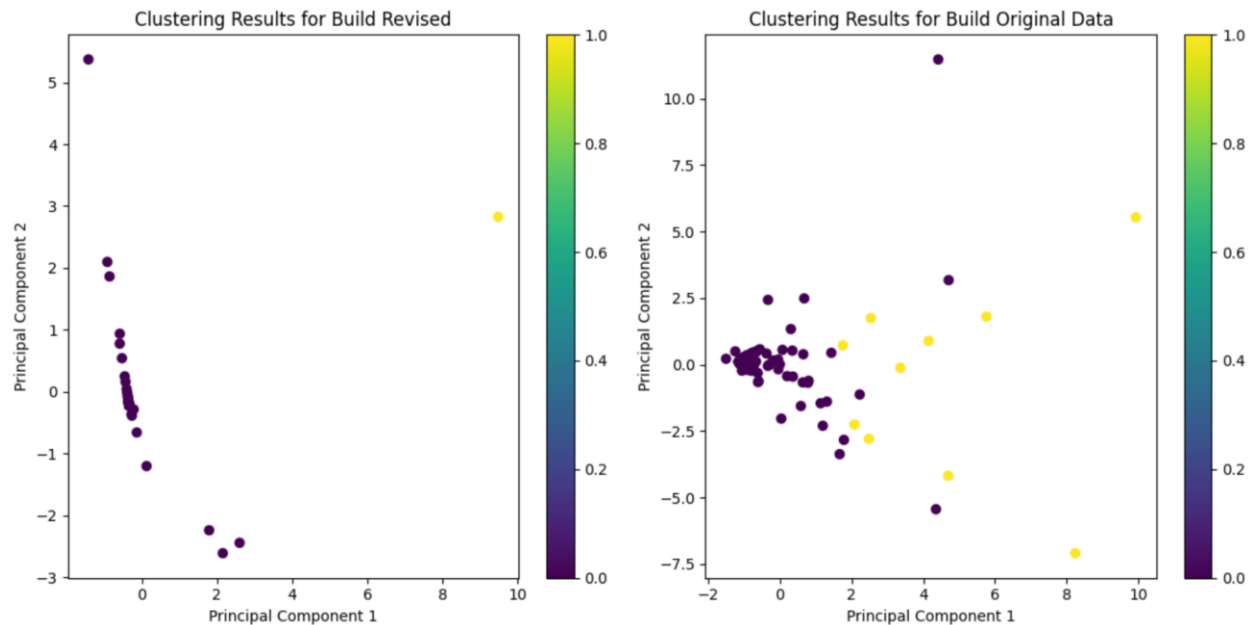
- BOW Coded Data
  - Cluster 1 major subcategory: “1.01 Scope Changes”
  - Cluster 2 major subcategory: “1.99 Others”
  
- Original Data
  - Cluster 1 major subcategory: “1.01 Scope Changes”
  - Cluster 2 major subcategory: “8.02 Public Health”
  - Lots of projects which should have been labeled as “scope changes” were labelled as “others”
  - Public health is mainly correlated with covid, such outliers will disappear less in the future.

**Bid**



- BOW Coded Data
  - Cluster 1 major subcategory: “2.02 Delay by External Stakeholder”
  - Cluster 2 major subcategory: “6.03 Procurement Management”
  
- Original Data
  - Cluster 1 major subcategory: “2.02 Delay by External Stakeholder”
  - Cluster 2 major subcategory: “6.03 Procurement Management”
  - There are highly similar characteristics in these two clusters, which means that the classifying methods did a relatively good job in Bid division.

## Build



- BOW Coded Data
  - Cluster 1 major subcategory: “9.02 Private Utilities”
  - Cluster 2 major subcategory: “3.01 Funding”
  - This outlier here is Project 123, which is a railroad reconstruction project in Brooklyn, and is one of the few projects delayed caused by funding shortage in the infrastructure build division. This also caused one of the longest delay periods.
  
- Original Data
  - Cluster 1 subcategory: “9.02 Private Utilities” and “9.03 Subsurface Field Conditions”
  - Cluster 2 subcategory: “9.02 Private Utilities” and “9.99 Others”
  - Private utilities are the major delay subcategory, most delayed projects in this phase experienced “private utilities” issues. Some projects are mislabeled into “others” as well, but overall, the classifying is more accurate than in the design phase.

## 10. Scope and Limitations

### 10.1 Scope

- Focuses on construction delays in public buildings and infrastructure projects managed by the NYC DDC.

- Data from the DDC's delay data set is analyzed to identify the main causes of delays, categorized by project type (public building and infrastructure) and construction stage (design, bid, and build).
- Aims to provide insights into the primary causes of delays, enabling the development of targeted strategies to reduce delays and improve project management practices.
- Utilizes text analytics, including Bag-of-Words and clustering, to analyze delay descriptions and identify common themes and patterns.

## **10.2 Limitations**

- Relies on the accuracy and completeness of the Delay Data set provided by the DDC. Any inaccuracies or missing data in this set could impact the validity of the findings.
- Limited to delays recorded by the DDC and may not capture delays that were not properly documented or reported.
- Focuses on delays in public buildings and infrastructure projects in New York City and may not be generalizable to other locations or types of construction projects.
- Might not consider more external factors such as regulatory changes, economic conditions, or unforeseen events (except for Covid-19, which was specifically addressed by removing related keywords) that may also contribute to construction delays. However, Covid-19 related delays were not excluded from original Delay Data for clustering analysis.
- The findings and recommendations of this analysis should be interpreted in the context of the specific projects and data analyzed and may not be applicable to all construction projects.
- The dataset is not perfect for clustering because there were only 25-50% of original data kept after completing principal component analysis.