GEOPHYSICAL ENGINEERING SURVEY REPORT

Industrial Site
42-11 9th Street,
Long Island City, New York 11101

NOVA PROJECT NUMBER:

19-1171

DATED:

February 21, 2019

PREPARED FOR:

Langan

21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001-2727

PREPARED BY:

NOVA
GEOPHYSICAL
ENGINEERING
Subsurface Mapping Solutions

56-01 Marathon Parkway # 765
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NOVA GEOPHYSICAL SERVICES

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February 21, 2019

Terrence Cheung
Project Manager
Langan
21 Penn Plaza
260 West 31st Street, 8th Floor
New York, New York 10001-2727
P: 212.479.5482 | E: tcheung@langan.com

Re: Geophysical Engineering Survey (GES) Report
Industrial Site
42-11 9th Street,
Long Island City, New York 11101

Dear Mr. Cheung,

Nova Geophysical Services (NOVA) is pleased to provide the findings of the geophysical engineering survey (GES) at the above referenced project site: 42-11 9th Street, Long Island City, New York 11101 (the "Site").

INTRODUCTION TO GEOPHYSICAL ENGINEERING SURVEY (GES)

NOVA performed a geophysical engineering survey (GES) consisting of a Ground Penetrating Radar (GPR) and Electromagnetic (EM) survey at the site. The purpose of this survey is to locate and identify utilities, underground storage tanks and other substructures as well as to clear and mark proposed boring locations on February 14th, 2019.

The equipment selected for this investigation was a Sensors and Software Noggin 250 MHz ground penetrating radar (GPR) with a shielded antenna and a Radio Detection RD7100 Electromagnetic utility locator.

A GPR system consists of a radar control unit, control cable, and transducer (antenna). The control unit transmits a trigger pulse at a normal repetition rate of 250 MHz. The trigger pulse is sent to the transmitter electronics in the transducer via the control cable. The transmitter electronics amplify the trigger pulse into bipolar pulses that are radiated to the surface. The

transformed pulses vary in shape and frequency according to the transducer used. In the subsurface, variations of the signal occur at boundaries where there is a dielectric contrast (void, steel, soil type, etc.). Signal reflections travel back to the control unit and are represented as color graphic images for interpolation.

A typical electromagnetic (EM) utility locating system consists of a transmitter unit and a receiver unit. The receiver unit can be used independently of the transmitter unit in order to detect utility lines with an inherent EM signature (electric utility lines, water lines, etc.). If needed a current at a specific frequency can also be placed on a utility that is being located. This can be done via the transmitter unit by either direct connection or induction via an EM field varying at specific frequency. The receiver unit is then set to the selected frequency and the electromagnetic field created by the current running through the utility can be located allowing the utility to be marked.

GEOPHYSICAL METHODS

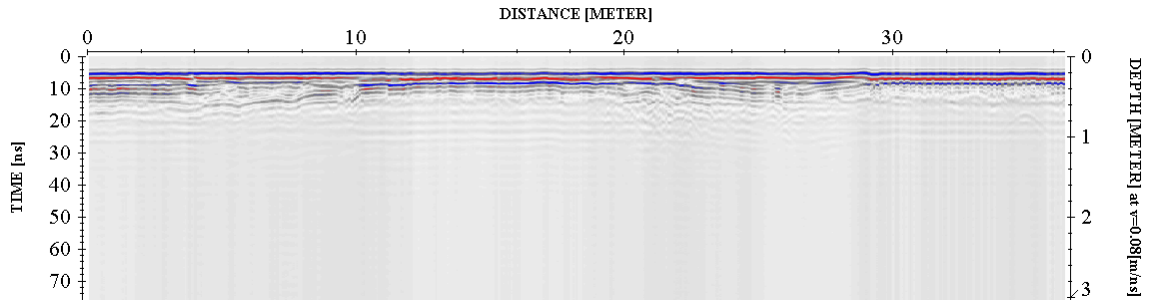
The project site was screened using GPR to search the specified area and inspected for reflections, which could be indicative of substructures and utilities within the subsurface. An EM utility locator was used to help determine the locations of utilities within the survey area.

EM data was collected and interpreted on site and suspected utilities marked as needed. GPR data profiles were collected for the areas of the Site specified by the client and processed as specified below.

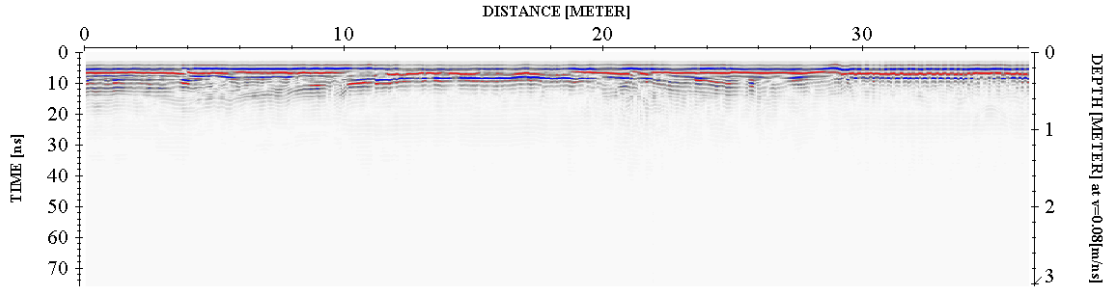
DATA PROCESSING

In order to improve the quality of the results and to better identify anomalies NOVA processed the collected data. The processing work flow is briefly described in this section.

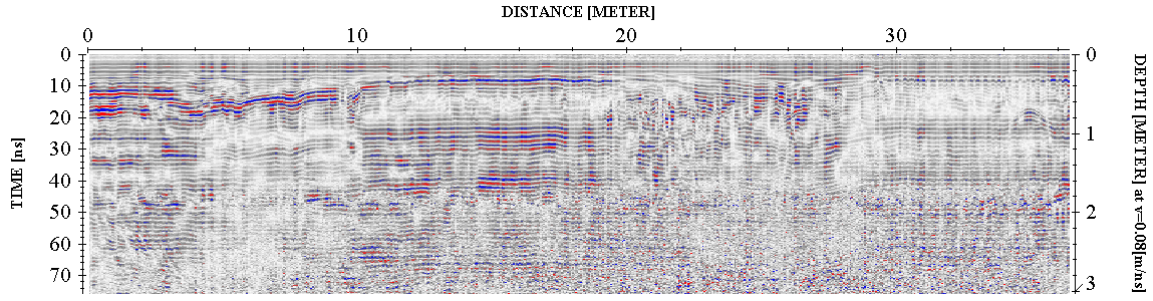
Step 1. Import Raw RAMAC data to standard processing format



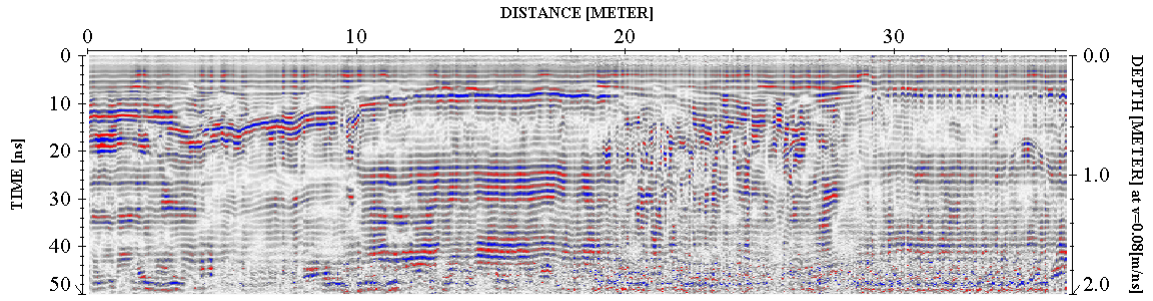
Step 2. Remove instrument noise *(dewow)*



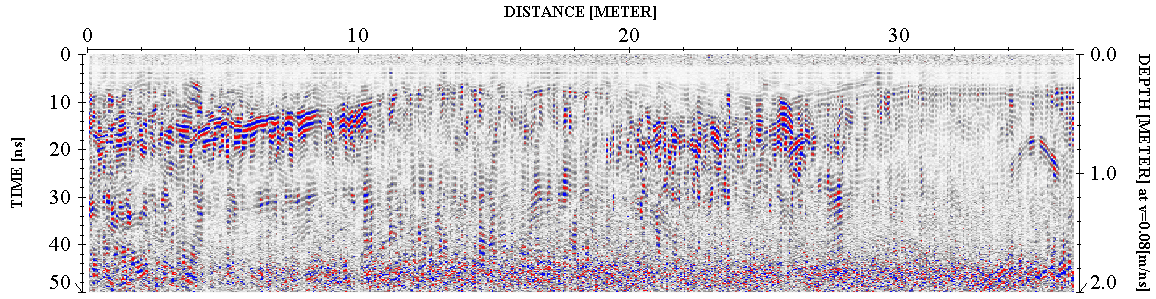
Step 3. Correct for attenuation losses *(energy decay function)*



Step 4. Remove static from bottom of profile *(time cut)*



Step 5. Mute horizontal ringing/noise *(subtracting average)*



The above example shows the significance of data processing. The last image (step 5) has higher resolution than the starting image (raw data – step 1) and represents the subsurface anomalies much more accurately.

PHYSICAL SETTINGS

NOVA observed the following physical conditions at the time of the survey.

Weather: Clear

Temperature: 40° F

Surface: Concrete

Geophysical Noise Level (GNL): The GNL was high at the site. The noise was a result of the site being located in an urban environment and thick concrete slabs. Additionally, large portions of the site were covered with immobile objects and could not be effectively surveyed.

RESULTS

The results of the geophysical engineering survey (GES) identified the following at the project site:

- Anomalies resembling potential subsurface utilities (such as water, electric, gas, and sewer) were identified during the GES. The approximate locations are shown in the survey plan.
- Two geophysical anomalies resembling high voltage dielectric oil transmission electric lines were identified during the GES. Shown in the survey plan.
- A large geophysical anomaly resembling a heavily reinforced area in the partial basement of the survey area was identified. Shown in the survey plan.
- No large geophysical anomalies resembling potential underground storage tanks (USTs) were identified during the GES.
- All detected subsurface anomalies were marked in the onsite mark out.
- All cleared boring locations were marked in the onsite mark out.

If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

NOVA Geophysical Services

Levent Eskicakit, P.G., E.P.

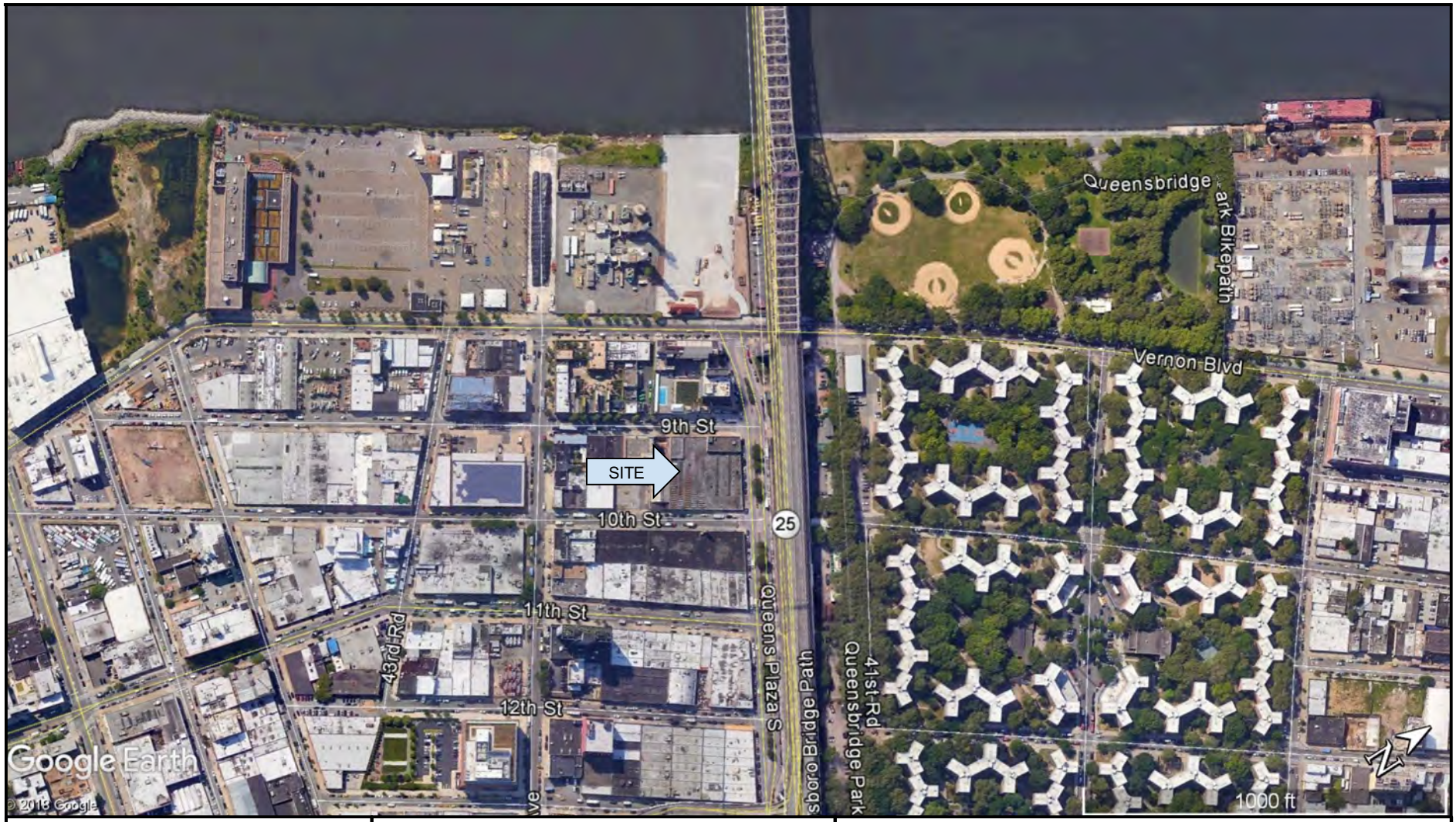
Project Engineer

Attachments:

Location Map

Survey Plan

Geophysical Images



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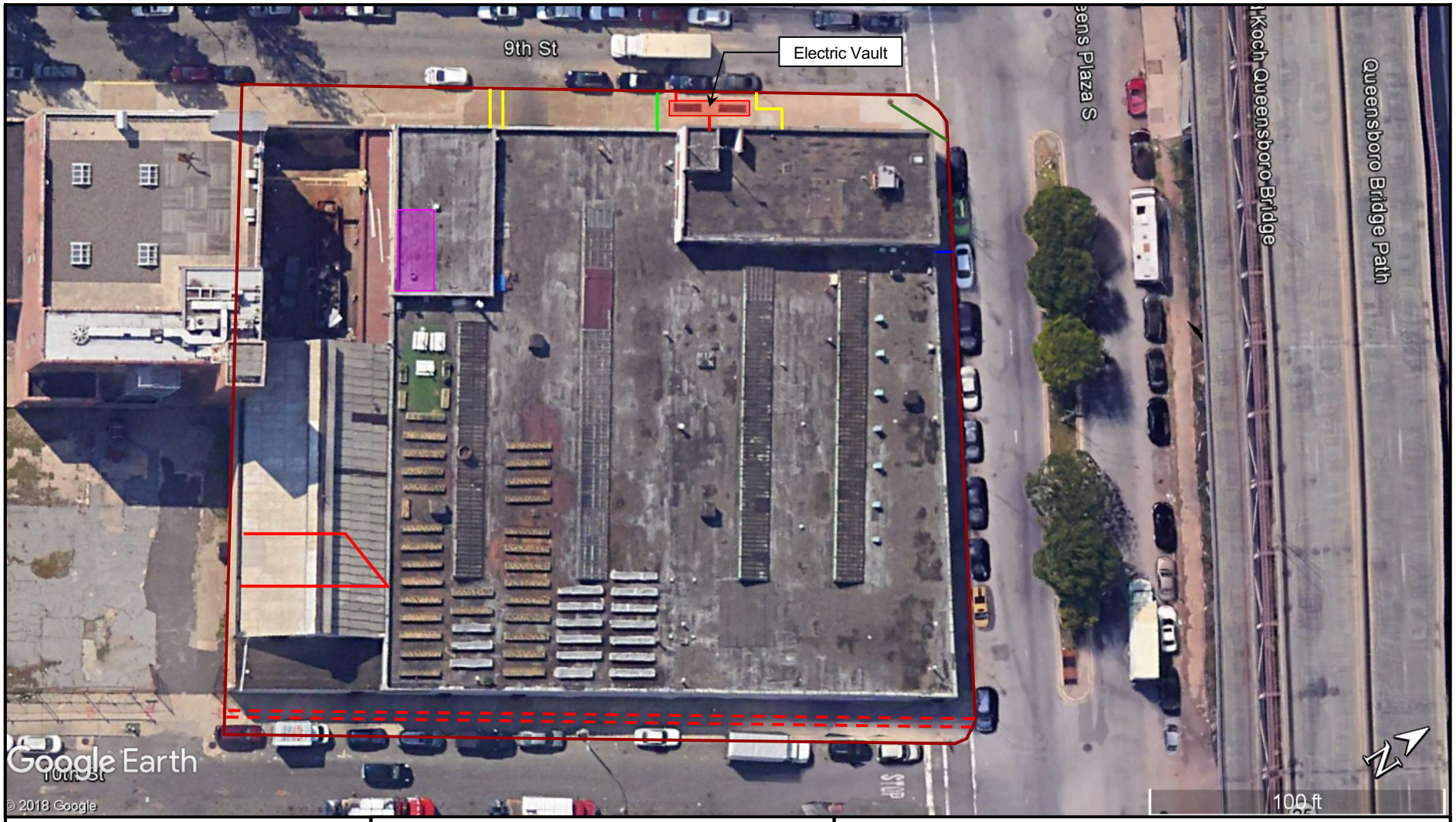
Location Map

SITE:	**Industrial Site** 42-11 9th Street, Long Island City, New York 11101
CLIENT:	Langan
DATE:	February 14th, 2019
AUTH:	Chris Steinley

LEGEND



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SURVEY PLAN

SITE:	**Industrial Site** 42-11 9th Street, Long Island City, New York 11101
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LEGEND

- Survey Area
- Reinforcement
- Sewer
- Water
- Electric
- Gas
- High Voltage Electric

GEOPHYSICAL IMAGES

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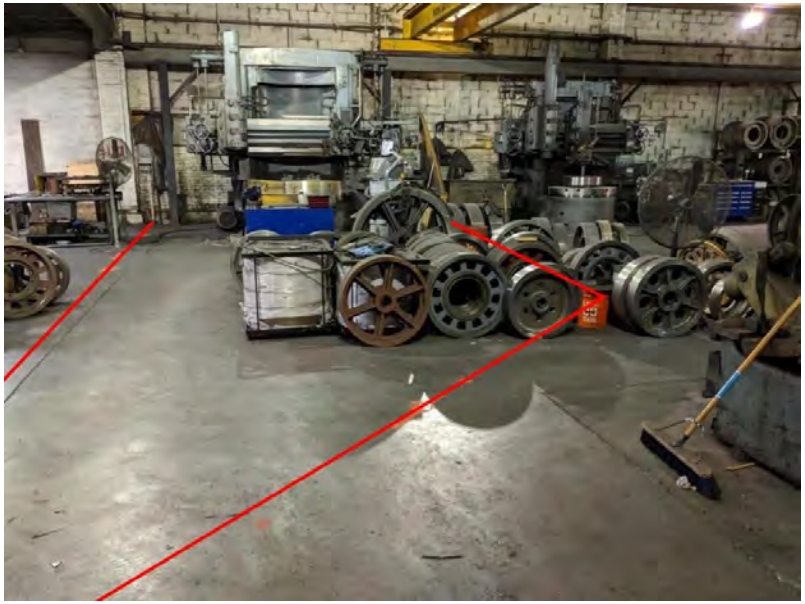

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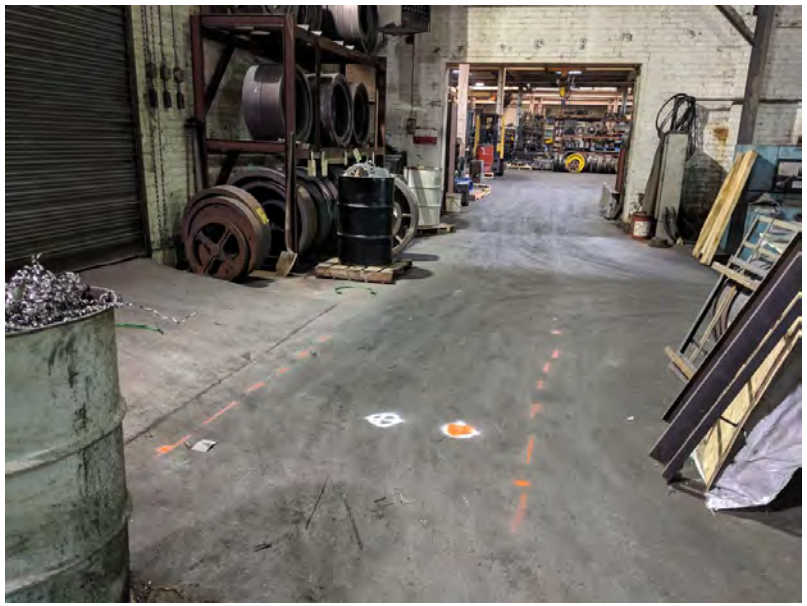

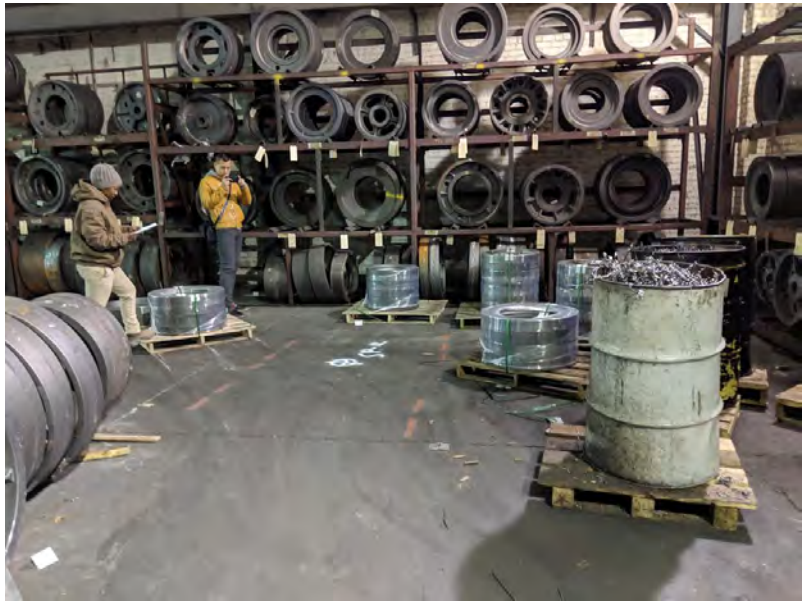

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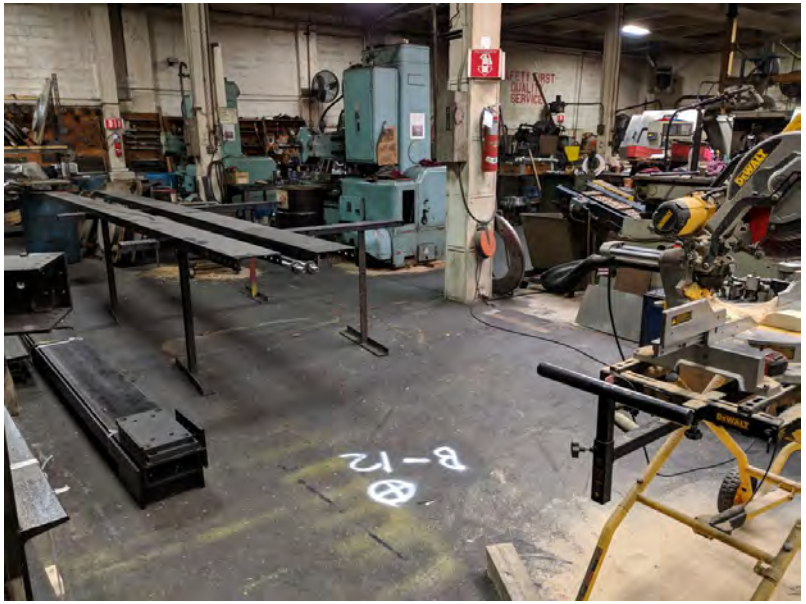

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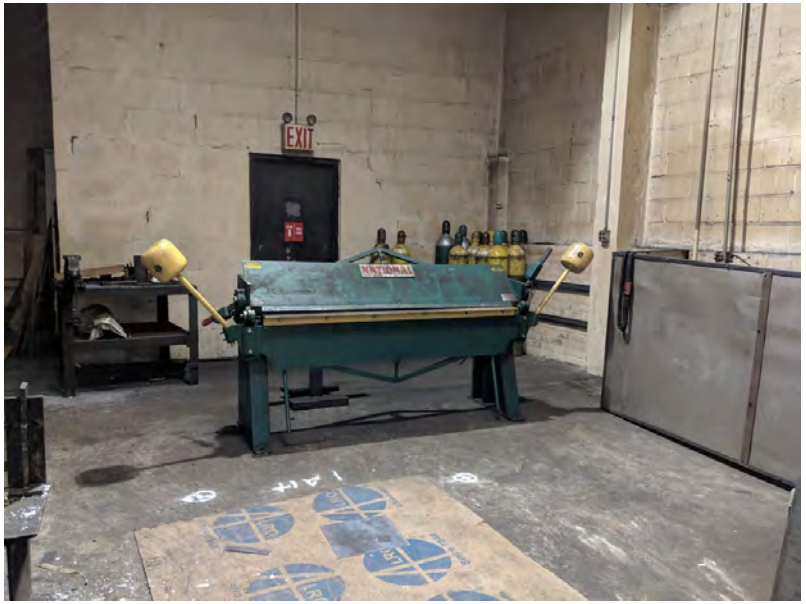

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