

**BRINKERHOFF**

ENVIRONMENTAL SERVICES, INC.



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January 18, 2011

Janine Hildebrand, EIT  
S. Harris, Ltd.  
2601 Pennsylvania Avenue, Suite Eight  
Philadelphia, PA 19130

Re: Geophysical Investigation Report  
Atlantic Avenue  
Brooklyn, New York  
Brinkerhoff Project No. 10BR194

Dear Ms. Hildebrand:

Brinkerhoff Environmental Services, Inc. (Brinkerhoff) is pleased to present the following summary report of the Geophysical Investigation conducted on January 11 and 14, 2011 at the above-referenced property (herein referred to as the subject property). Refer to Figure 1 – Site Location Map. Electromagnetic induction, electromagnetic soil conductivity, total field magnetics and ground penetrating radar (GPR) were employed for the investigation.

**Introduction**

On January 11 and 14, 2011, Brinkerhoff conducted a geophysical investigation on the subject property. The purpose of the geophysical investigation was to evaluate the potential presence of subsurface anomalies indicative of a buried 19<sup>th</sup> century locomotive and associated artifacts. The subject property is currently an active urban roadway surrounded by buildings to the north, south and east, while a large steel overpass (I-278) borders the subject property to the west.

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### **Methodology and Limitations**

- A. *Electromagnetic Induction*** – Electromagnetic data were collected using a Geonics EM61-MK2A High Sensitivity Metal detector (EM-61). The EM-61 was operated in the differential mode while recording magnetic metallic response measurements. The effective depth of data collection was approximately 10 feet. The field procedure involved device calibration, data collection and recording, and data storage for analysis in the office. Data were recorded on the Allegro Field Computer. Magnetic data and Differential Global Positioning System (DGPS) data, were simultaneously recorded at zero-point-two (0.2) second intervals (approximately every zero point five [0.5] feet) along survey lines at approximately two-point-five (2.5)-foot intervals. The data were downloaded to a personal computer for processing and the creation of an EM61 response contour map. Refer to Figure 2 – EM-61 Data Map
- B. *Electromagnetic Soil Conductivity Survey*** – Electromagnetic data were collected using a Geonics EM-31 Terrain Conductivity Meter. The EM-31 was operated in the vertical dipole mode while recording ground conductivity measurements. The effective depth of data collection was approximately 15 feet. The field procedures involved device calibration, data collection and recording, and data storage for analysis in the office. Data were recorded on the Allegro Filed Computer. Conductivity data and DGPS data, were recorded at zero-point-two (0.2) second intervals (approximately every zero point five [0.5] feet) along survey lines at approximately five (5)-foot intervals. The data were downloaded to a personal computer for processing and the creation of a conductivity contour map. Refer to Figure 3 – EM-31 Data Map.
- C. *Total Field Magnetics*** - The G-859 Self-oscillating split-beam Cesium Vapor Magnetometer (G-859) was operated in the simple survey mode while recording magnetic metallic response measurements. The effective depth of data collection was approximately 20 feet. The field procedure involved device calibration, data collection and recording, and data storage for analysis in the office. Data were collected in two (2) separate survey files, recorded on the G-859 console data logger and transferred via high speed USB cable to a portable computer for further analysis and map generation within the field. Magnetic data and integrated Wide Area Augmentation System (WAAS) GPS data were simultaneously collected throughout the total field magnetic survey with survey lines spaced approximately 10 feet apart. The data were downloaded to a personal computer for processing and the creation of a G-859 response contour map. Refer to Figure 4 – G-859 Data Map



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**D. Ground-Penetrating Radar (GPR) Survey** - GPR data were collected with a Sensors and Software Inc. Noggin<sup>plus</sup> SmartCart GPR System (SmartCart) utilizing a 250 MHz antenna. Data were collected continuously on 38 survey lines across selected open areas of the subject property. The survey lines were spaced approximately two (2) feet apart and oriented perpendicular to each other. The depth of investigation was from zero (0) to approximately three-point-five (3.5) feet with this antenna. The data were processed using Ekko View Deluxe software. Refer to Figure 5 - GPR Line Map.

**E. Limitations** - Limitations encountered during the investigation included the presence of possible subsurface utilities, metallic light poles, suspect concrete road bedding, vehicles, vegetation, snow, refuse piles, adjacent structures and the I-278 overpass. Please note that Electromagnetic Induction, Terrain Conductivity, Total Field Magnetics and GPR measurement are remote sensing methods and in some instances, due to interference or other geophysical limitations, do not reveal data which may be indicative of subsurface anomalies. The findings of this investigation should only be used as a tool in evaluating the possibility that a locomotive is present on the property and should not be considered a guarantee regarding the presence or absence of a locomotive.

### **Geophysical Results**

**EM-61 Results:** The EM-61 survey was limited to all outside accessible areas of the subject property. Several areas of anomalous change in magnetic susceptibility gradient were seen in the EM-61 data. Analysis of the EM-61 data showed that these anomalies coincided with observable surface features and/or the location of possible building materials.

**EM-31 Results:** The EM-31 survey was limited to all outside accessible areas of the subject property. Several areas of anomalous change in magnetic susceptibility gradient were seen in the EM-31 data. Analysis of the EM-31 data showed that these anomalies coincided with observable surface features and/or the location of possible building materials. One (1) large anomaly was identified within the EM-31 data and the location of the anomaly is shown on Figure 3. Brinkerhoff then further investigated anomaly A-1 with GPR.

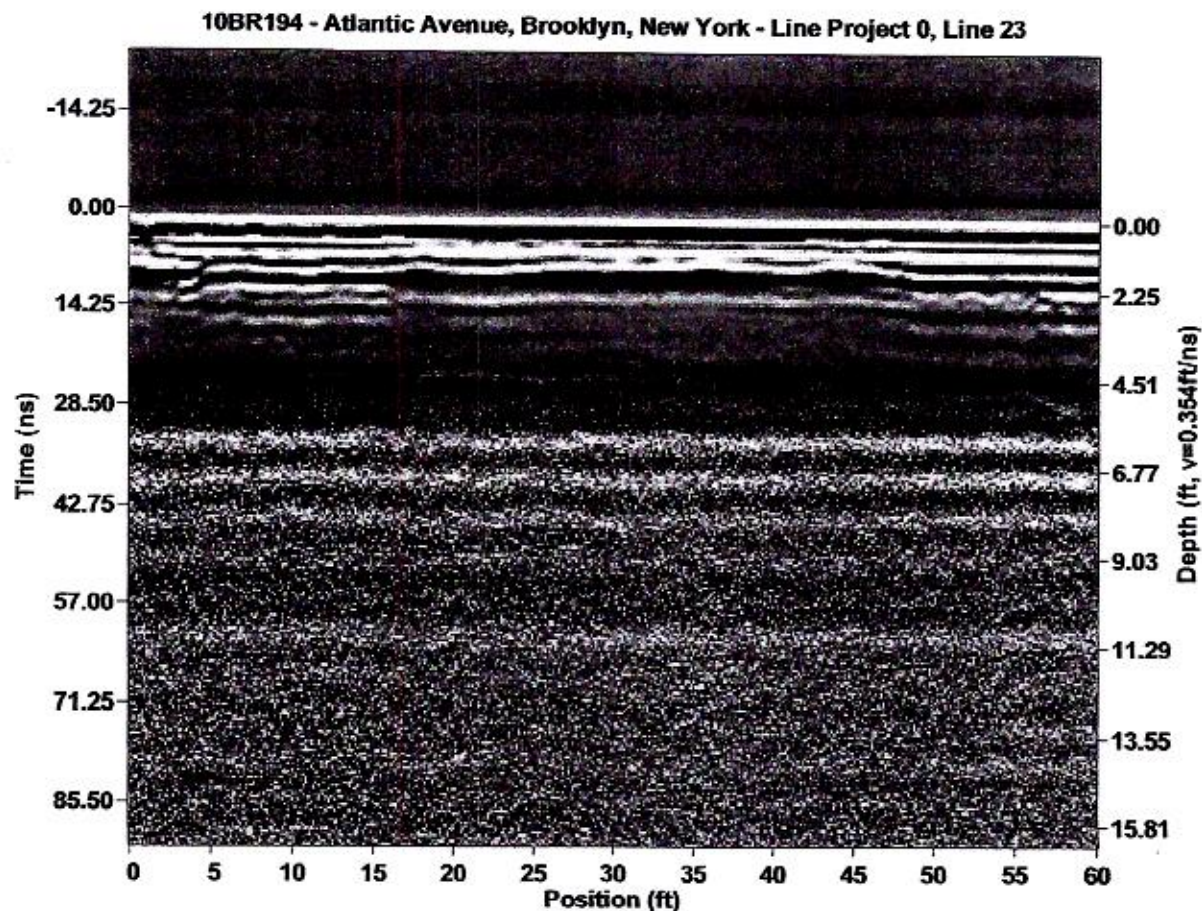
**G-859 Results:** G-859 survey was limited to all outside accessible areas of the subject property. One (1) area of anomalous change in magnetic susceptibility gradient was seen in the G-859 data. Analysis of the G-859 data revealed a large metallic anomaly measuring approximately 20 feet in length. The location of the anomaly is shown on Figure 4. Brinkerhoff then further investigated anomaly A-1 with GPR.



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**GPR Results:** GPR data was collected from the areas of anomaly A-1. Due to the assumed unconsolidated geology, brick and assumed concrete below the surface of the roadway, GPR was unable to penetrate further than three-point-five (3.5) feet below grade. Brinkerhoff was unable to verify the presence of the large magnetic anomaly which was detected in both the EM-31 and G-859 surveys. Representative GPR profiles are presented below.

**Anomaly A-1** – GPR data was collected from the area of Anomaly A-1, as noted in the EM-31 and G-859 data. Based upon the EM-31 and G-859 data images, the anomaly is located largely on the eastern side of Atlantic Avenue; however, the anomaly's large response extends across Atlantic Avenue encompassing the western lanes as well. GPR data collected in the area of A-1 is inconclusive due to restricted GPR signal penetration within the subsurface geology. A representative GPR profile collected from this area showing A-1 and the GPR's restricted signal is shown below.



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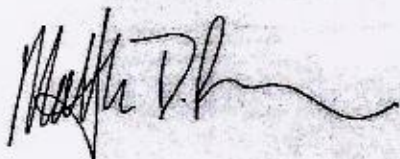
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## GEOPHYSICAL CONCLUSIONS

On January 11 and 14, 2011, Brinkerhoff performed a geophysical investigation in open and accessible areas of the subject property. Limitations encountered during the investigation included the presence of possible subsurface utilities, metallic light poles, suspect concrete road bedding, vehicles, vegetation, snow, refuse piles, adjacent structures and the I-278 overpass. Please note that Electromagnetic Induction, Terrain Conductivity, Total Field Magnetism and GPR measurement are remote sensing methods and in some instances, due to interference or other geophysical limitations, do not reveal data which may be indicative of subsurface anomalies. One (1) large subsurface metallic anomaly was identified extending across Atlantic Avenue and encompassing both the west bound and east bound roadway. Brinkerhoff was able to estimate the metallic anomaly's length at 20 feet based upon the response of the G-859 data. The anomaly was outlined in white spray paint in the field and is noted on the attached Figure 3 and Figure 4.

This report has been prepared and is respectfully submitted by

BRINKERHOFF ENVIRONMENTAL SERVICES, INC.



January 18, 2011

MATTHEW D. POWERS  
Director of Geophysical Services

Date





Figure 9.jpg



APPENDIX B

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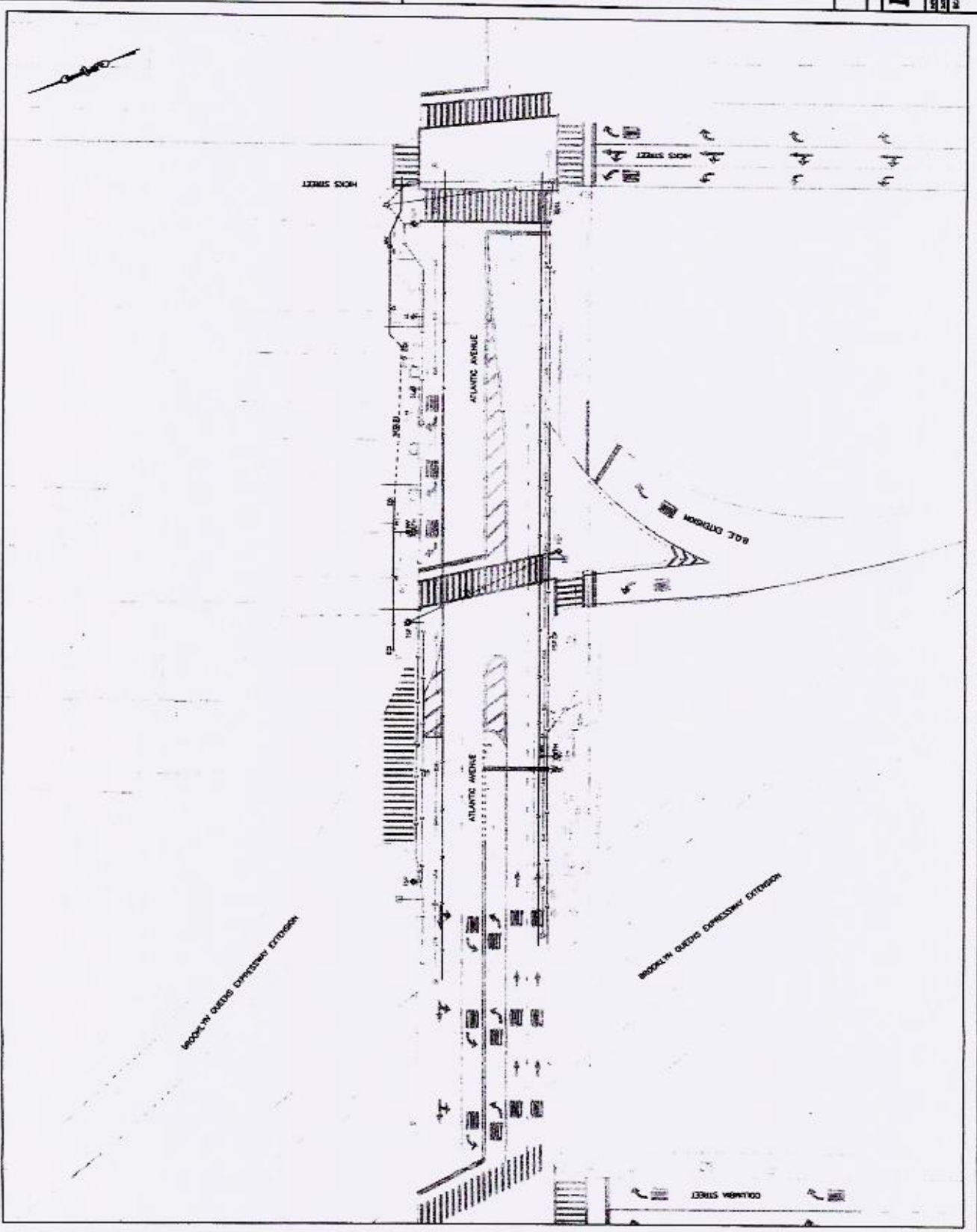
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Atlantic Avenue Tunnel Investigation  
Brooklyn, Kings County, NY

Prepared for: R. Harris Ltd

InfraMap

PROJECT NAME: ATLANTIC AVENUE TUNNEL INVESTIGATION	DATE: 11/12/01	SCALE: NOT TO SCALE
PROJECT NO: 1001-1111	DESIGNED BY: J.C.	DRAWN BY: J.C.
CHECKED BY: J.C.	APPROVED BY: J.C.	DATE: 11/12/01

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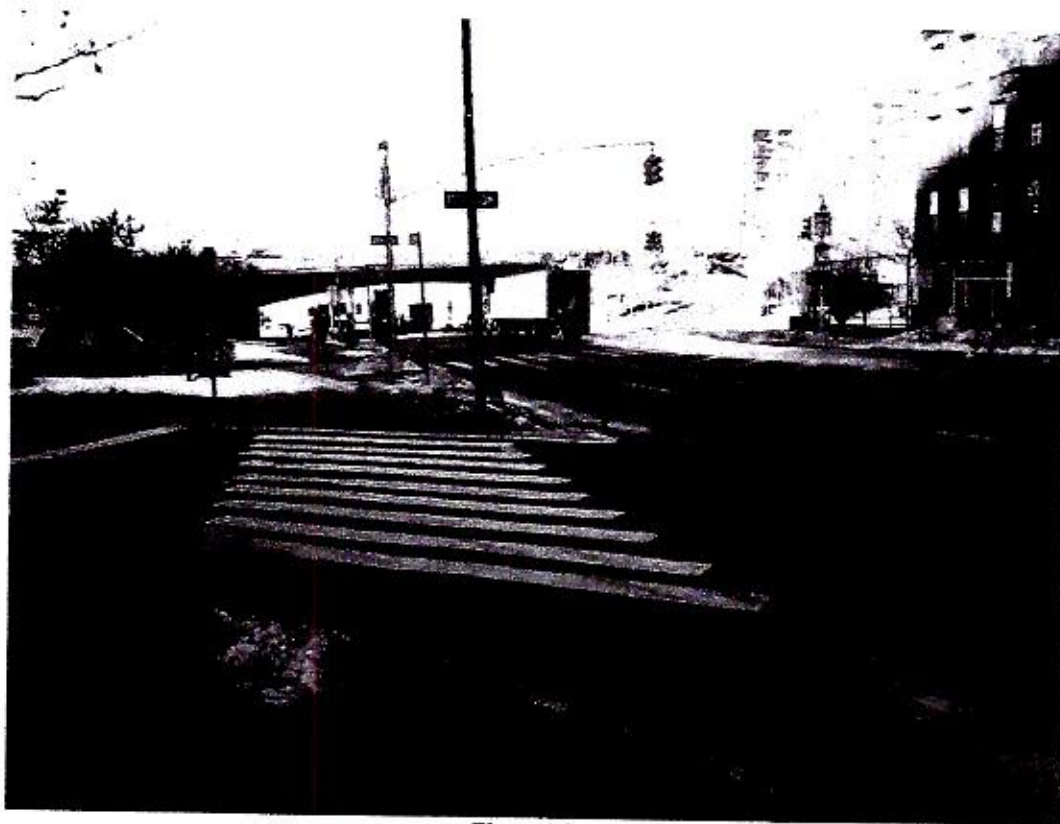


Figure 1.jpg

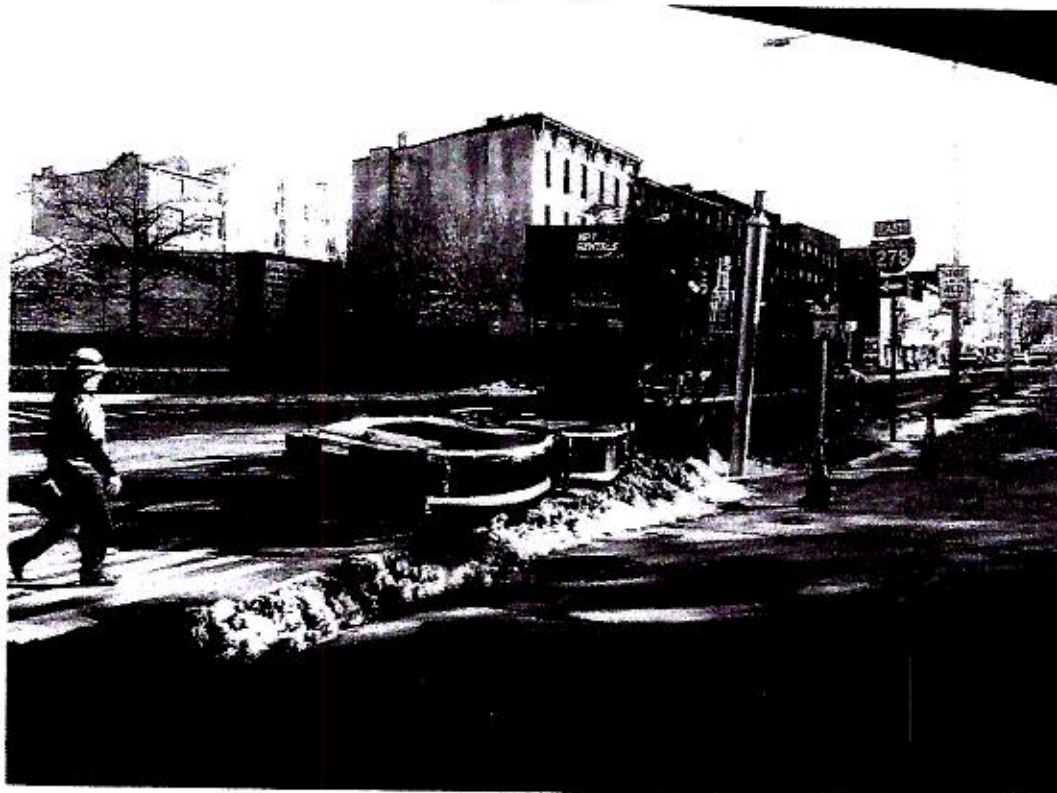


Figure 2.jpg



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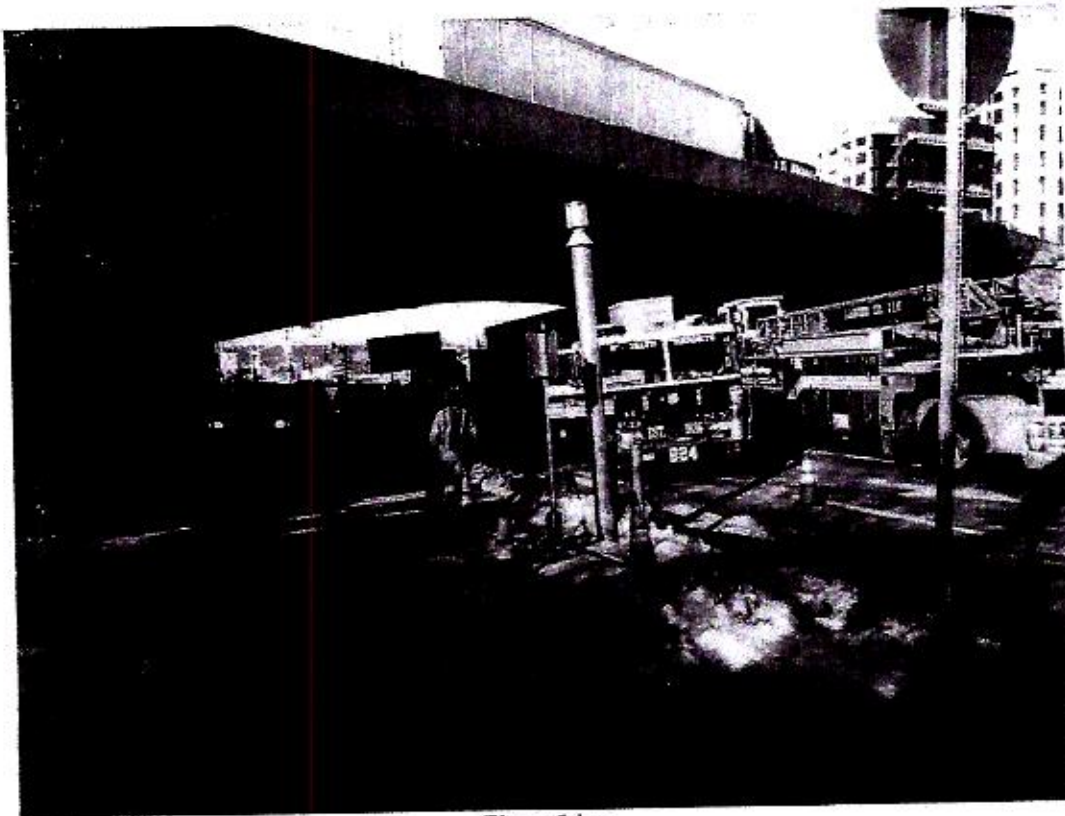


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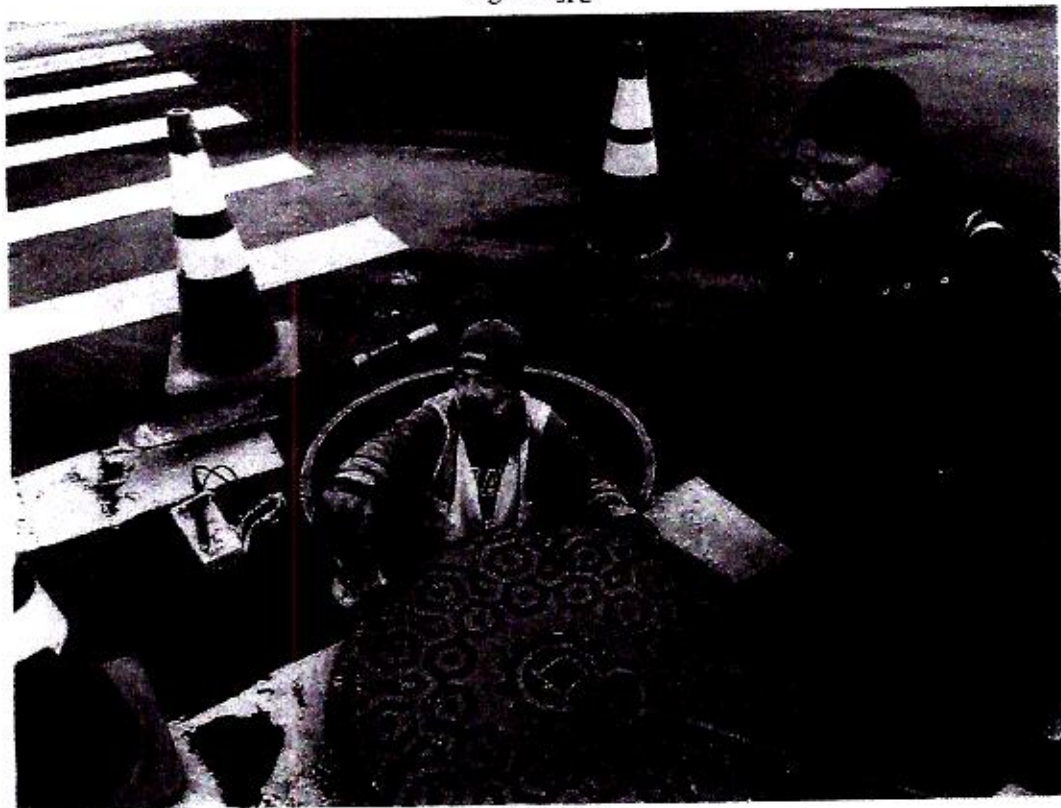


Figure 4.jpg

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Figure 5.jpg



Figure 6.jpg



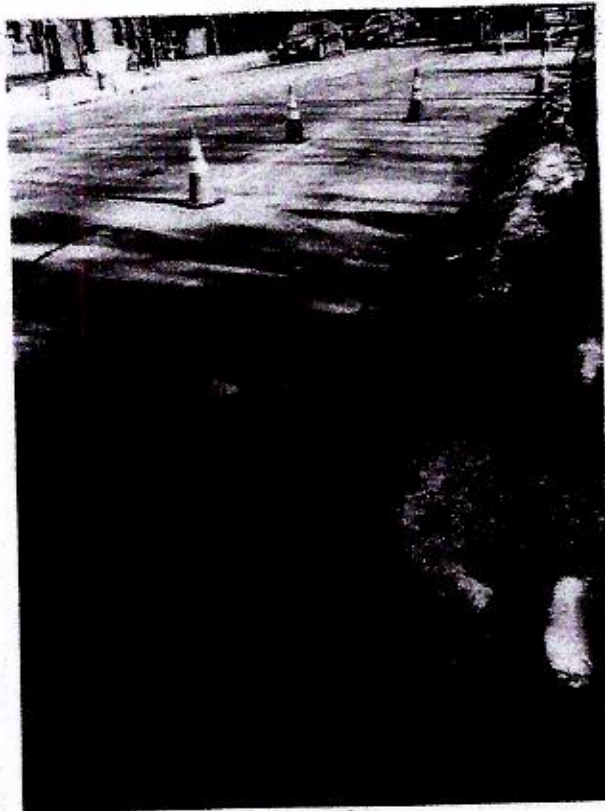


Figure 7.jpg

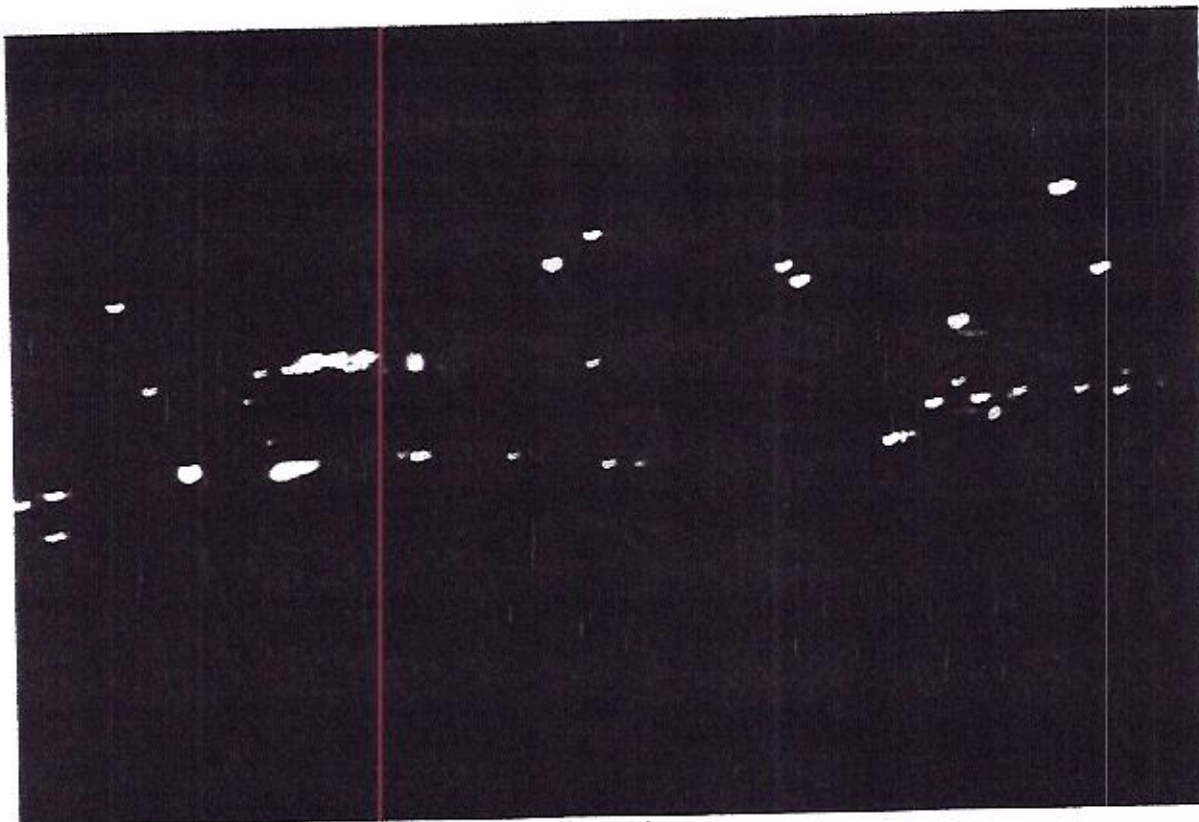


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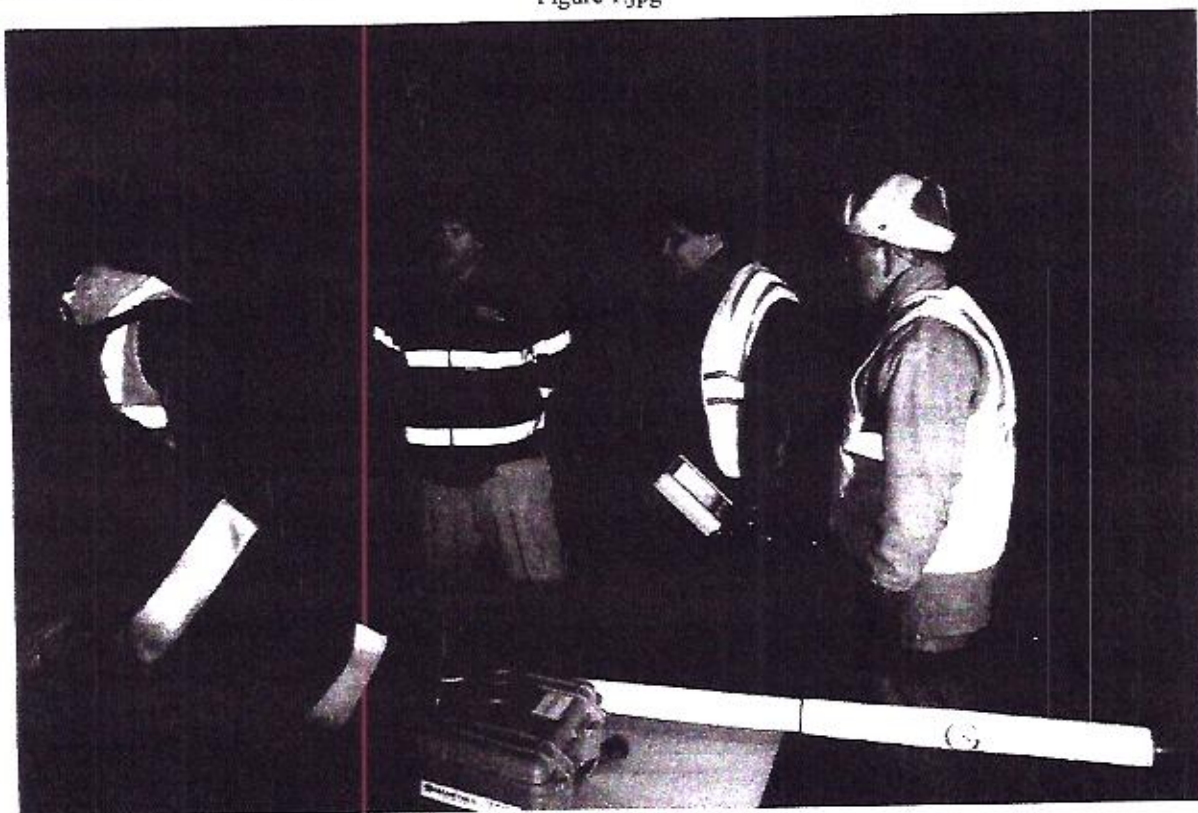


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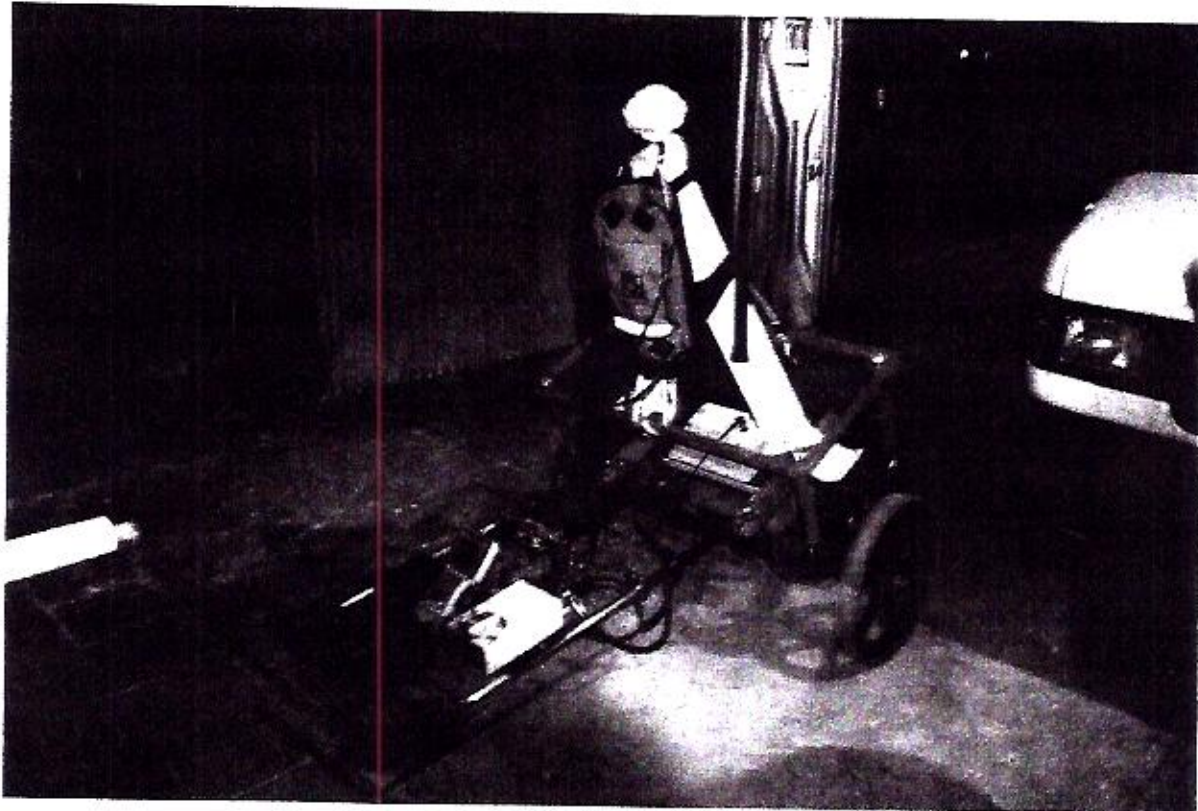


Figure 3.jpg



Figure 4.jpg

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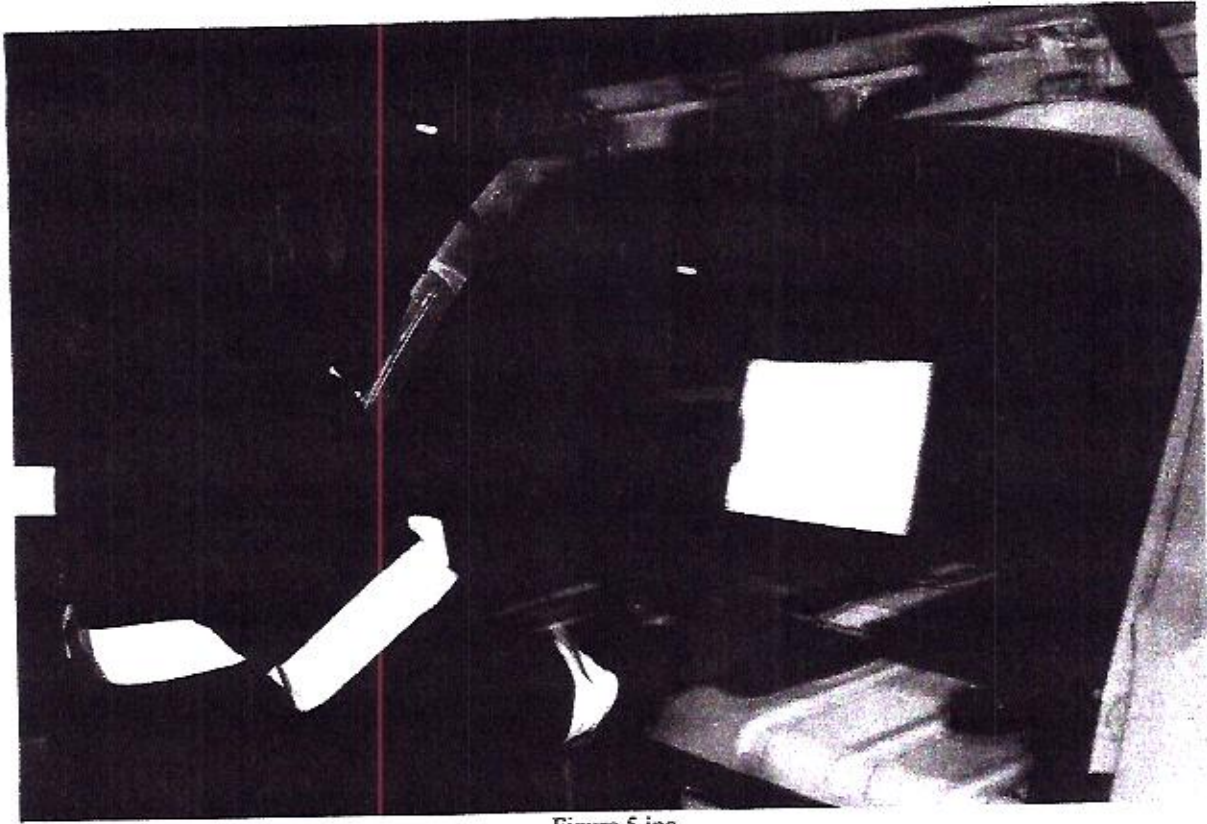


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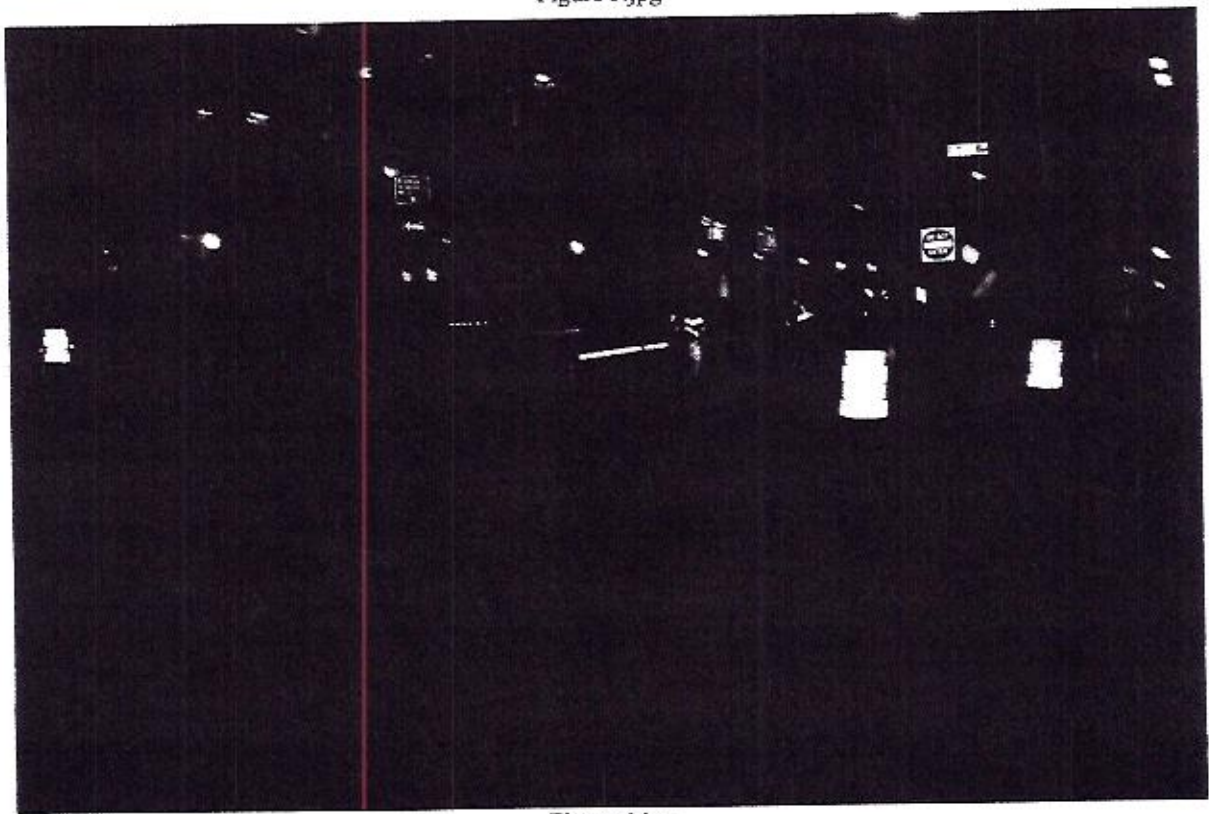


Figure 6.jpg



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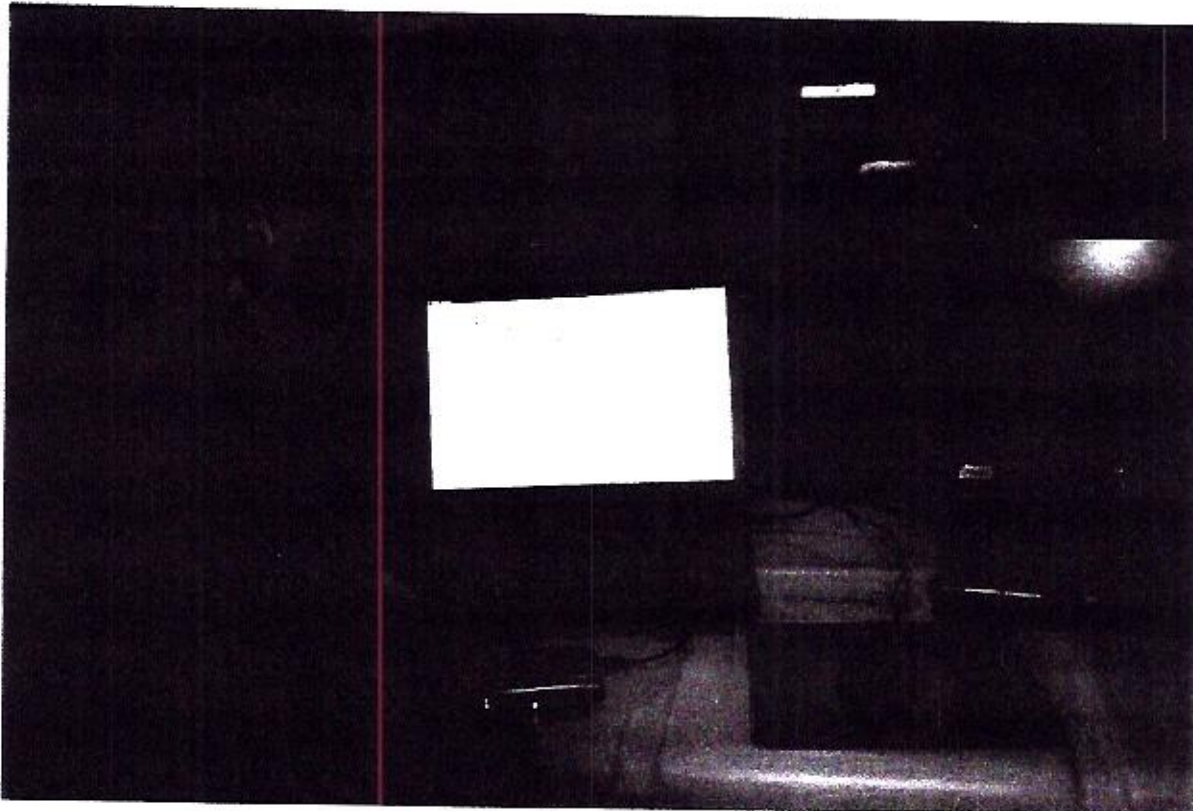


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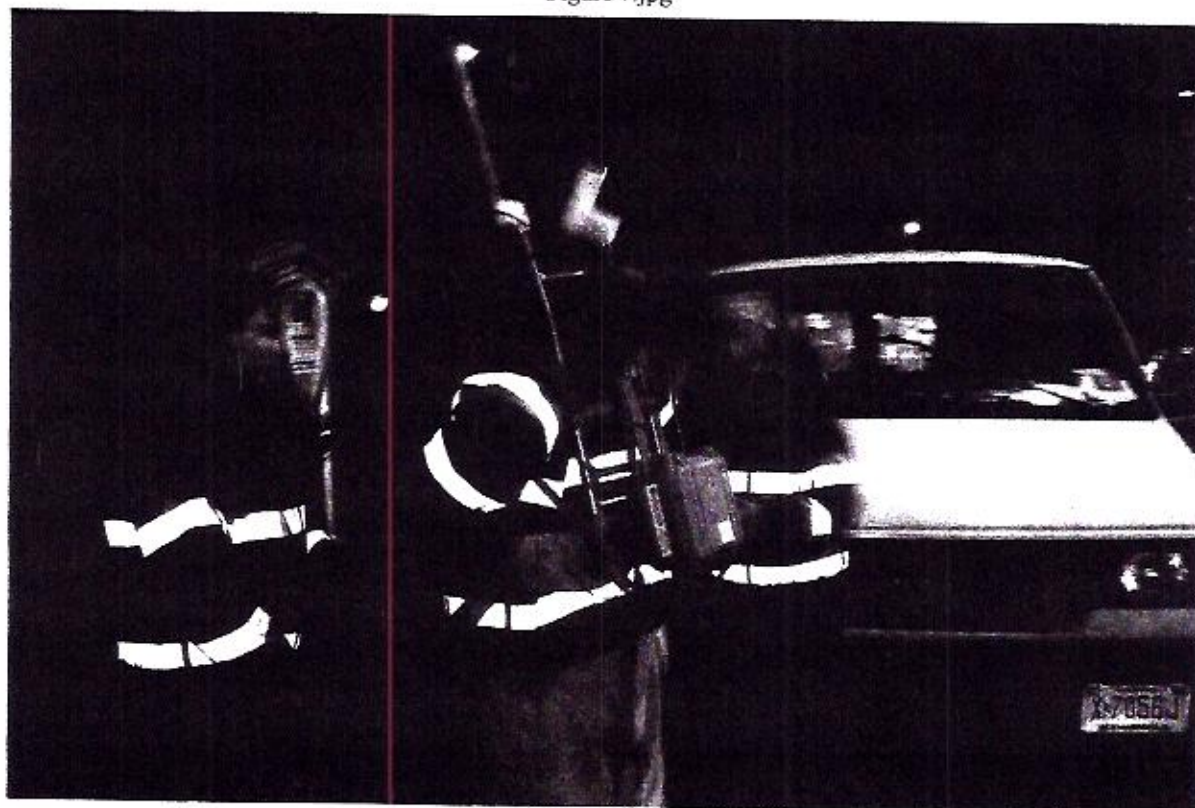


Figure 8.jpg

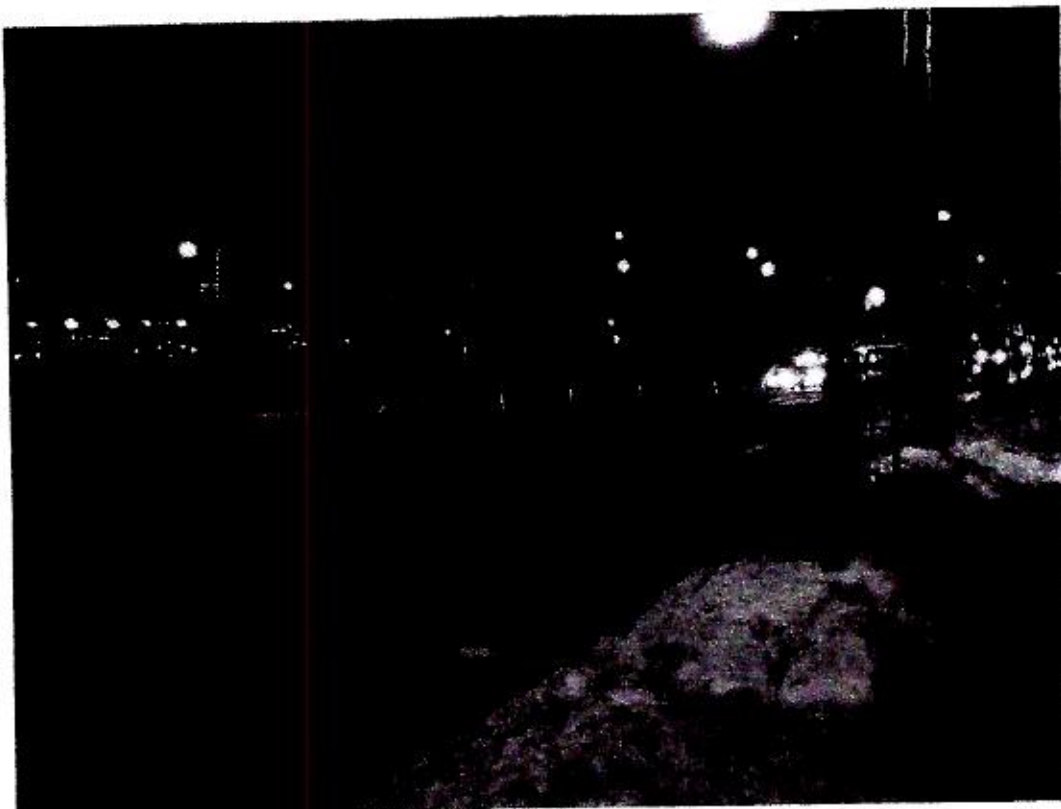


Figure 1.jpg

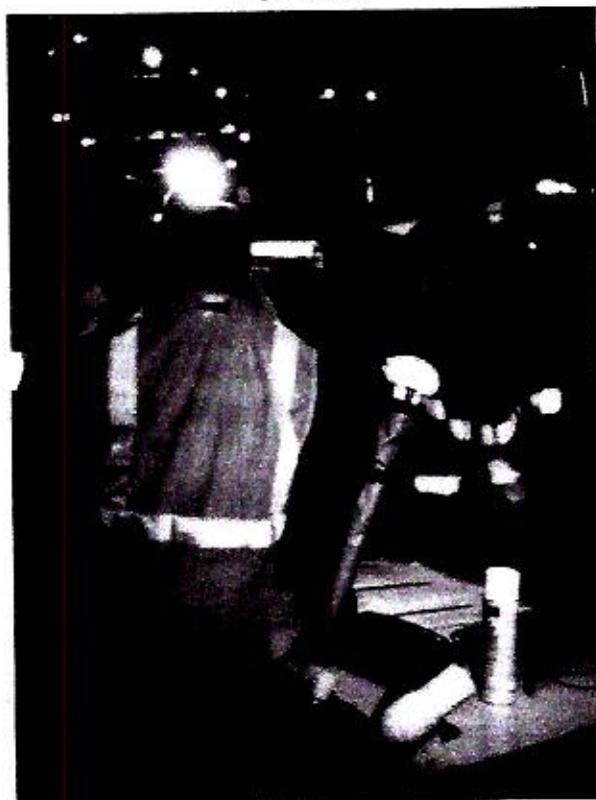


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Figure 1.jpg

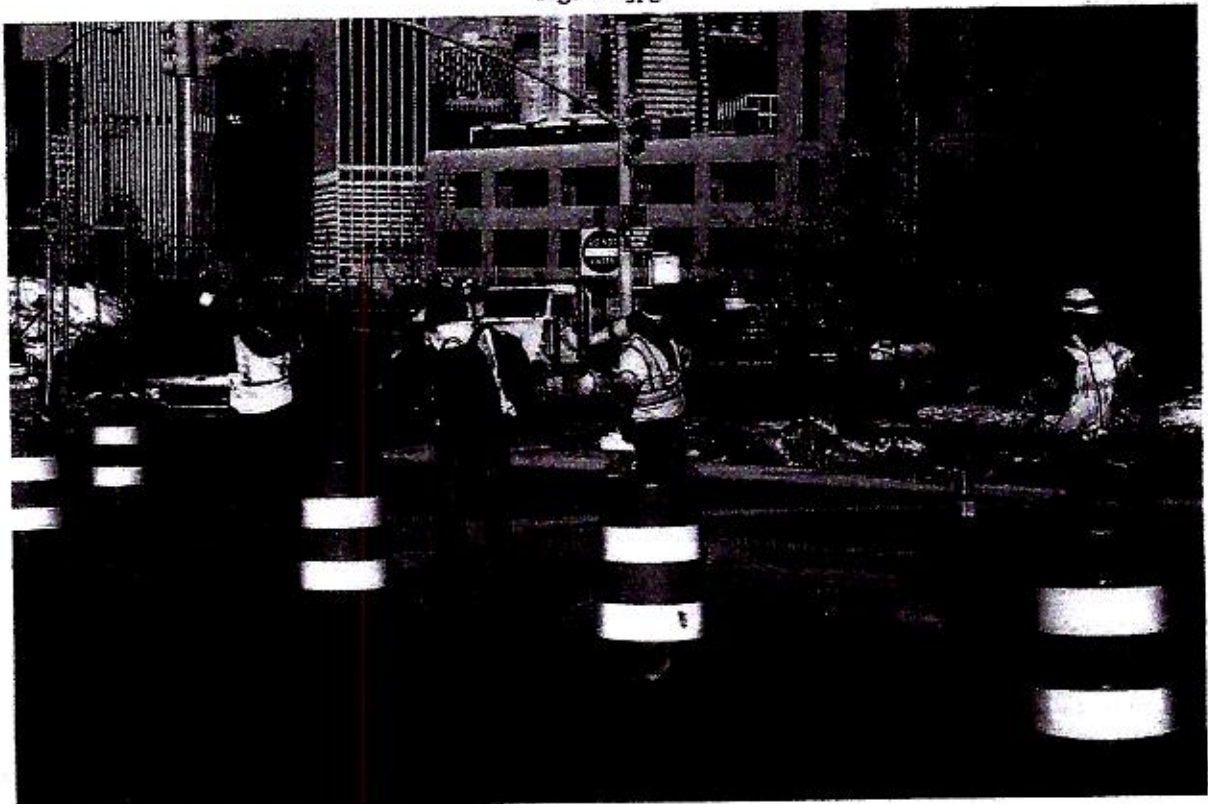


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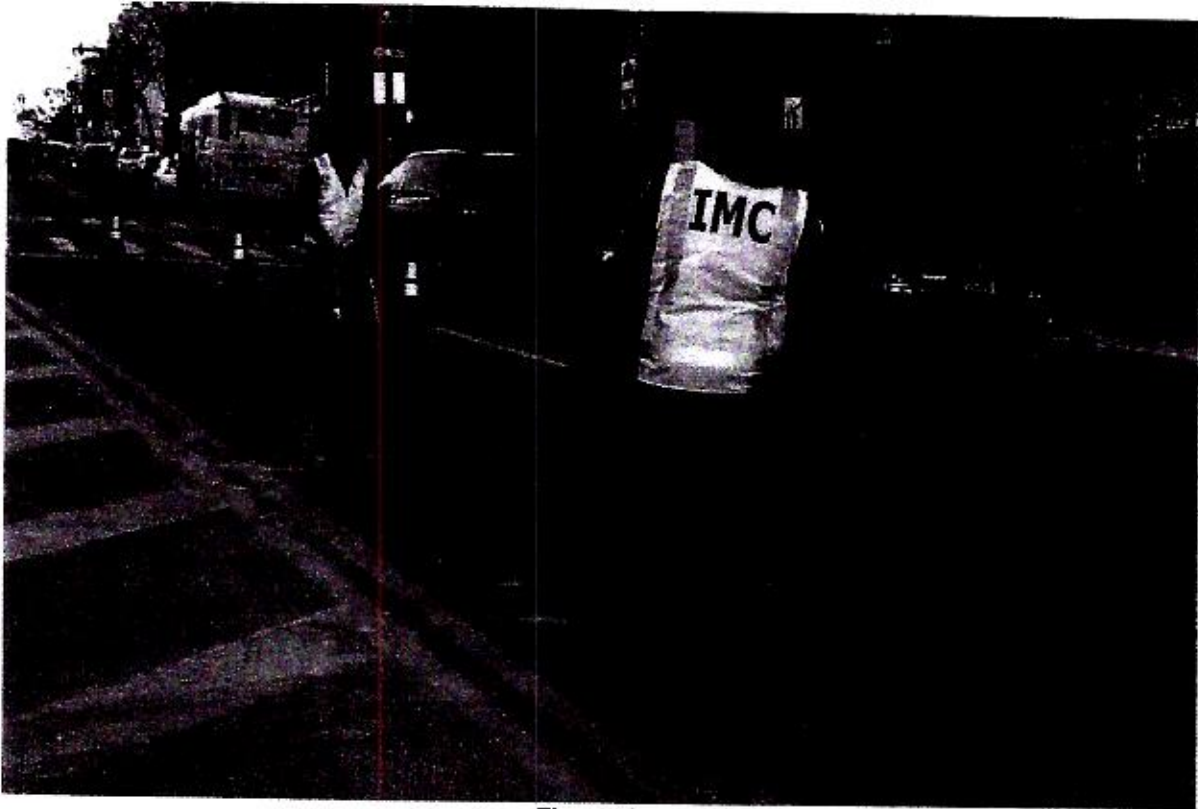


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Figure 4.jpg



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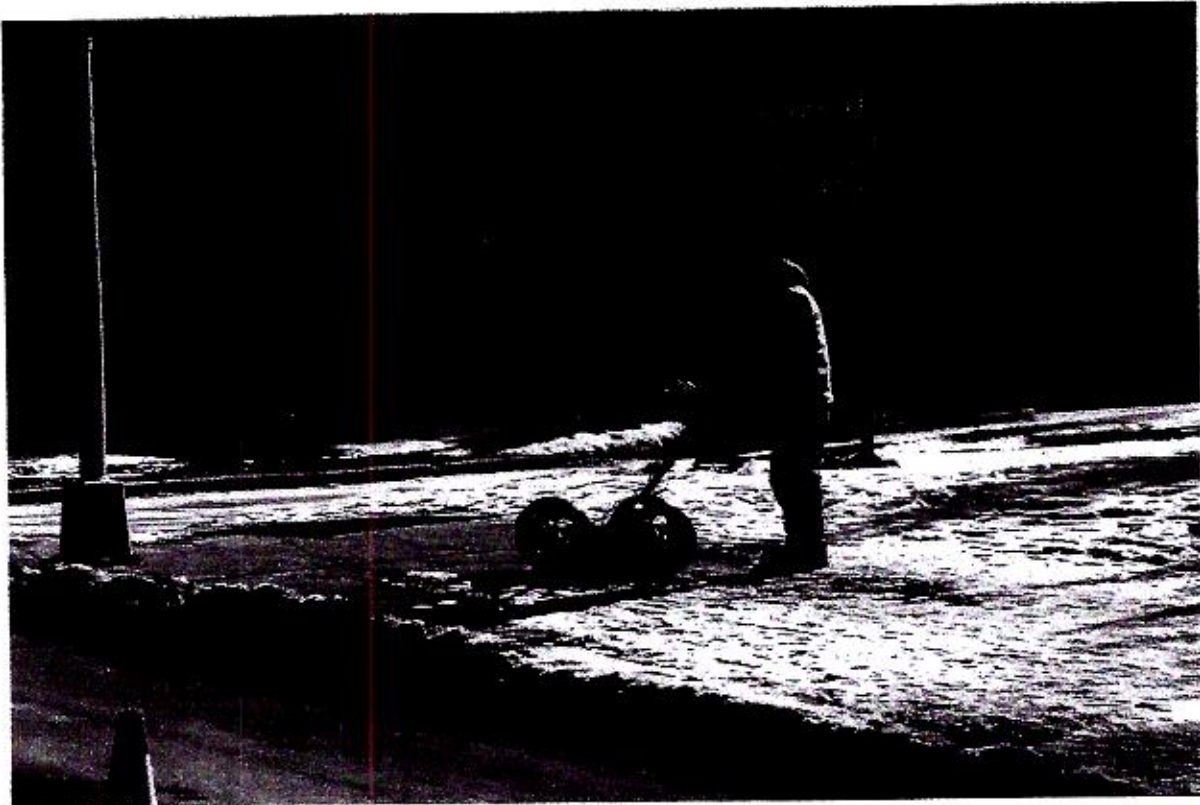


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