

UTILIZATION OF DRONES AND SCANNING TECHNOLOGY IN REMEDIATION AND REDEVELOPMENT

October 16, 2019

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Presentation Overview

- *Current uses at SME*
- *Commercial Drone Technology*
- *3D Laser Scanning*
- *Questions?*

COMMERCIAL sUAS (DRONE) TECHNOLOGY

What is an sUAS?



sUAS = “small Unmanned Aerial System”

- Under 55 lbs aircraft and payload
- 14 CFR Part 107 Regulated for commercial use
- Section 333 Exemption for drones over 55 lbs
- Includes VTOL (vertical take-off and landing) and fixed-wing drones

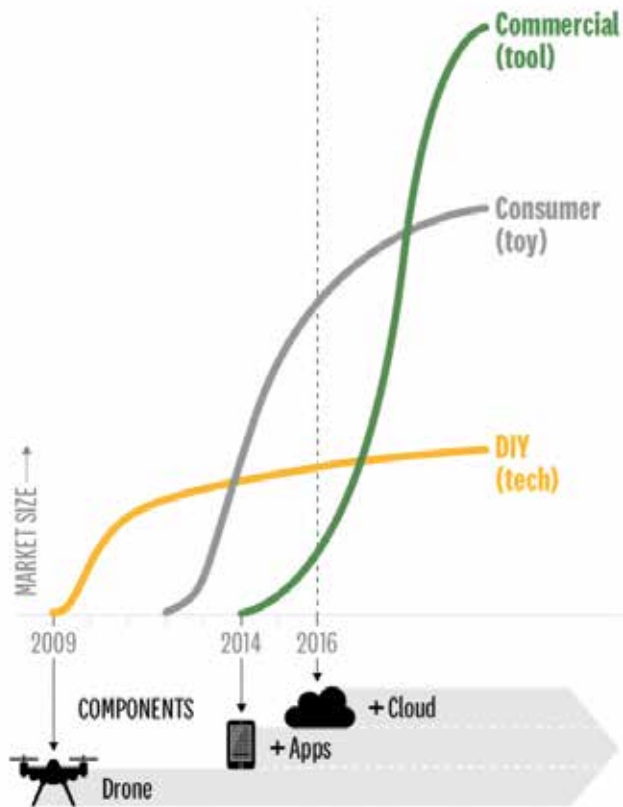
Imaging Sensors

- Visible Light (camera)
 - Stills
 - Video
- Thermal
- Light Detection and Ranging (LIDAR)
- Multispectral

Why Are We Talking About Them?

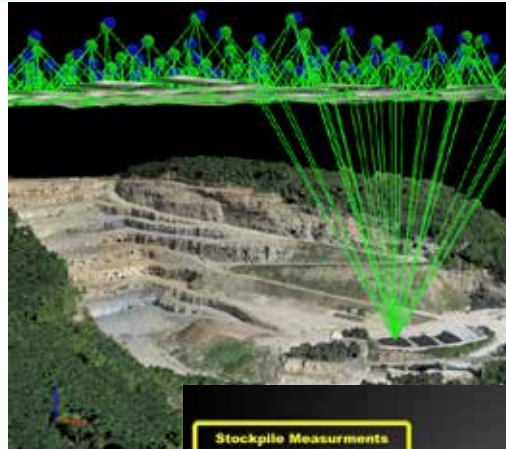
The Three Waves of the Drone Economy

MARKET EVOLUTION



SOURCE CHRIS ANDERSON

© HBR.ORG



Diverse Applications

- Photogrammetry
- LiDAR scanning
- Volumetric scans
- Repeatable & safer inspections

Flight Control – Drone Deploy & Pix4D



Equipment Cost Lowering / Tech Improving

DJI Mavic 2 Pro

(\$2,500 with iPad/case/accessories)



What can they do? - Good...



What can they do? - Good...



What can they do? - *Better...*

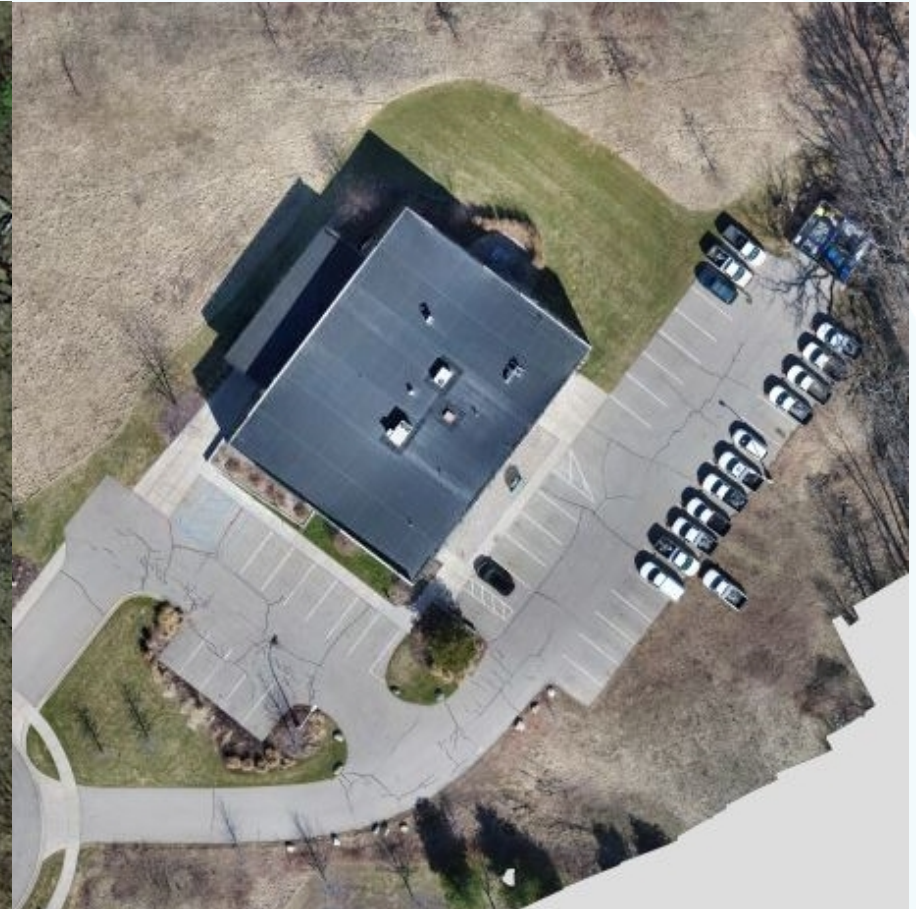


What can they do? - *Better...*

4/23/17



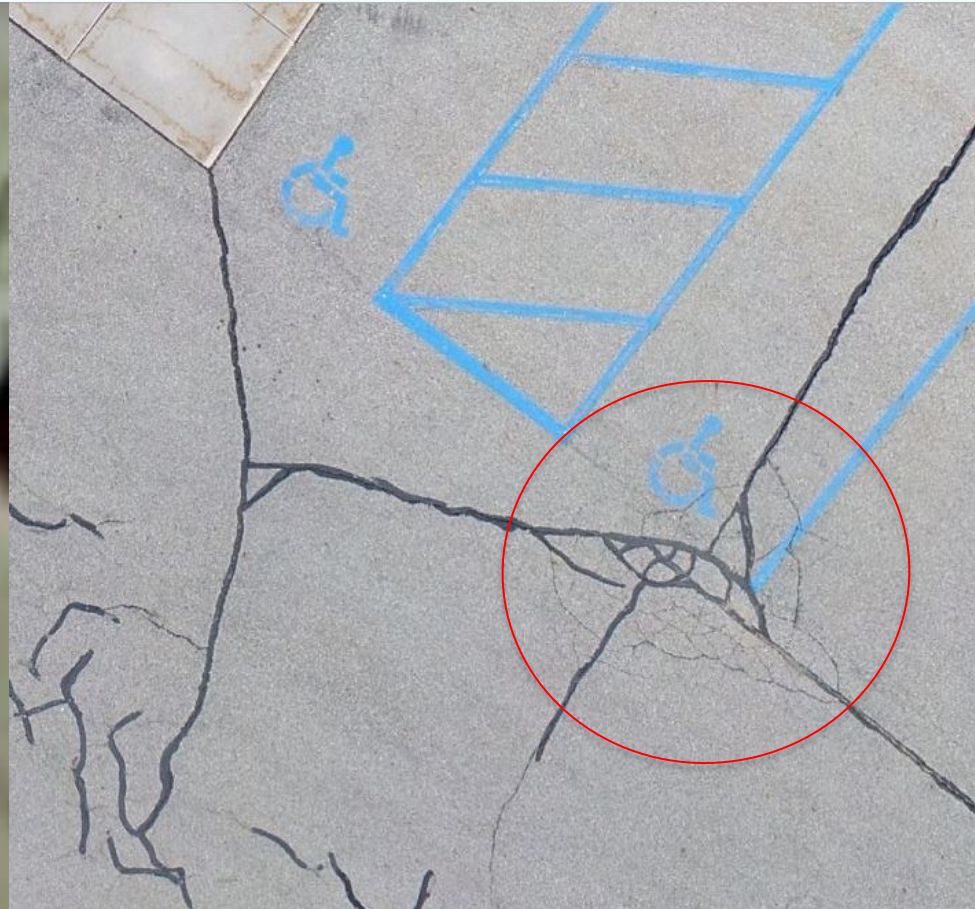
During Today's Site Visit



What can they do? - *Better...*

4/23/17

During Today's Site Visit



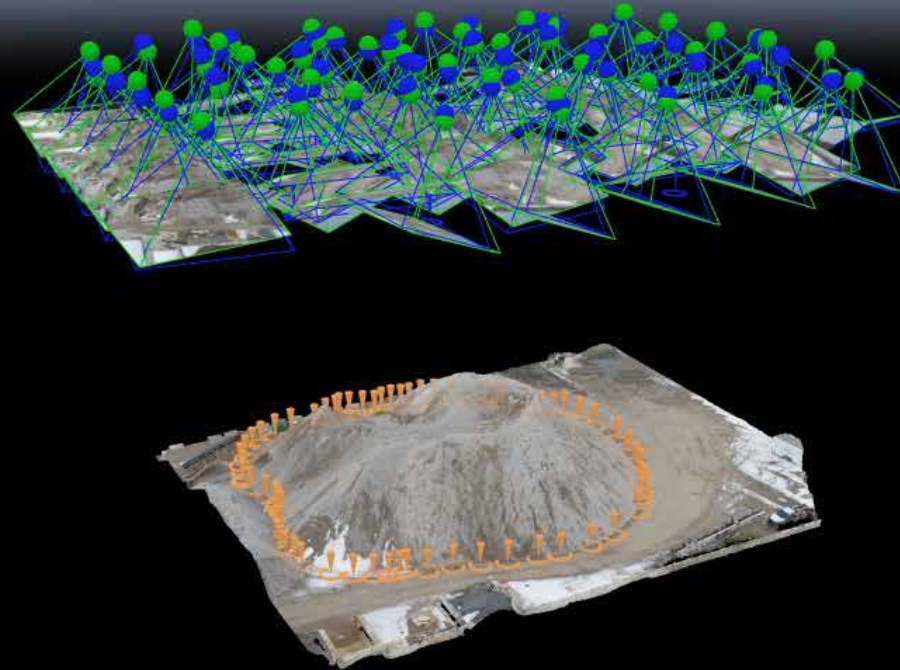
Technical Considerations

- Higher Resolution
 - Pros
 - More accurate data
 - Better photo quality
 - Cons
 - Longer flight time
 - More batteries consumed
 - More GCP's set = more field work
- Accuracy
 - 100' AGL = $\pm 0.10''$
 - 200' AGL = $\pm 0.20''$

Crushed Concrete Volume Survey – Plan View



Crushed Concrete Volume Survey



Pix4Dmapper



Case Study – Former AMC Headquarters

Former American Motors Headquarters Building Site Stockpile Quantities 14250 Plymouth Road Detroit, Michigan 48227



DATE: 08/10/20
SCALE: GRAPHIC SCALE: 1" = 82'
PROJECT: FORMER AMERICAN MOTORS HEADQUARTERS BUILDING



CLIENT

DETROIT ECONOMIC GROWTH CORP.
510 Griswold Street
SUITE 2200
DETROIT MI 48226
PH: 313-963-2940
CONTACT: CLEVELAND DAILEY

SURVEYOR

SME
41980 PLYMOUTH OAKS BLVD.
PLYMOUTH, MI 48170
CONTACT: MR. FREDD ZIOBRON, P.S.
PH: 734.454.9930

LIST OF DRAWINGS

| SHEET NO. | SHEET TITLE |
|-----------|----------------------------|
| C-100 | COVER SHEET |
| C-200 | OVERALL TOPOGRAPHIC SURVEY |
| C-300 | STOCKPILE DIAGRAM |
| C-301 | STOCKPILE DIAGRAM |
| C-302 | STOCKPILE DIAGRAM |

Project Location:
14250 PLYMOUTH ROAD
DETROIT, MI 48227

Sheet Name:
COVER SHEET

Engineer's Seal:

| REVISION | DATE | BY |
|----------|------|----|
| | | |
| | | |
| | | |
| | | |



Date:

MS Project No.: 080107.00

Project Manager: CAK

Substation: ZM

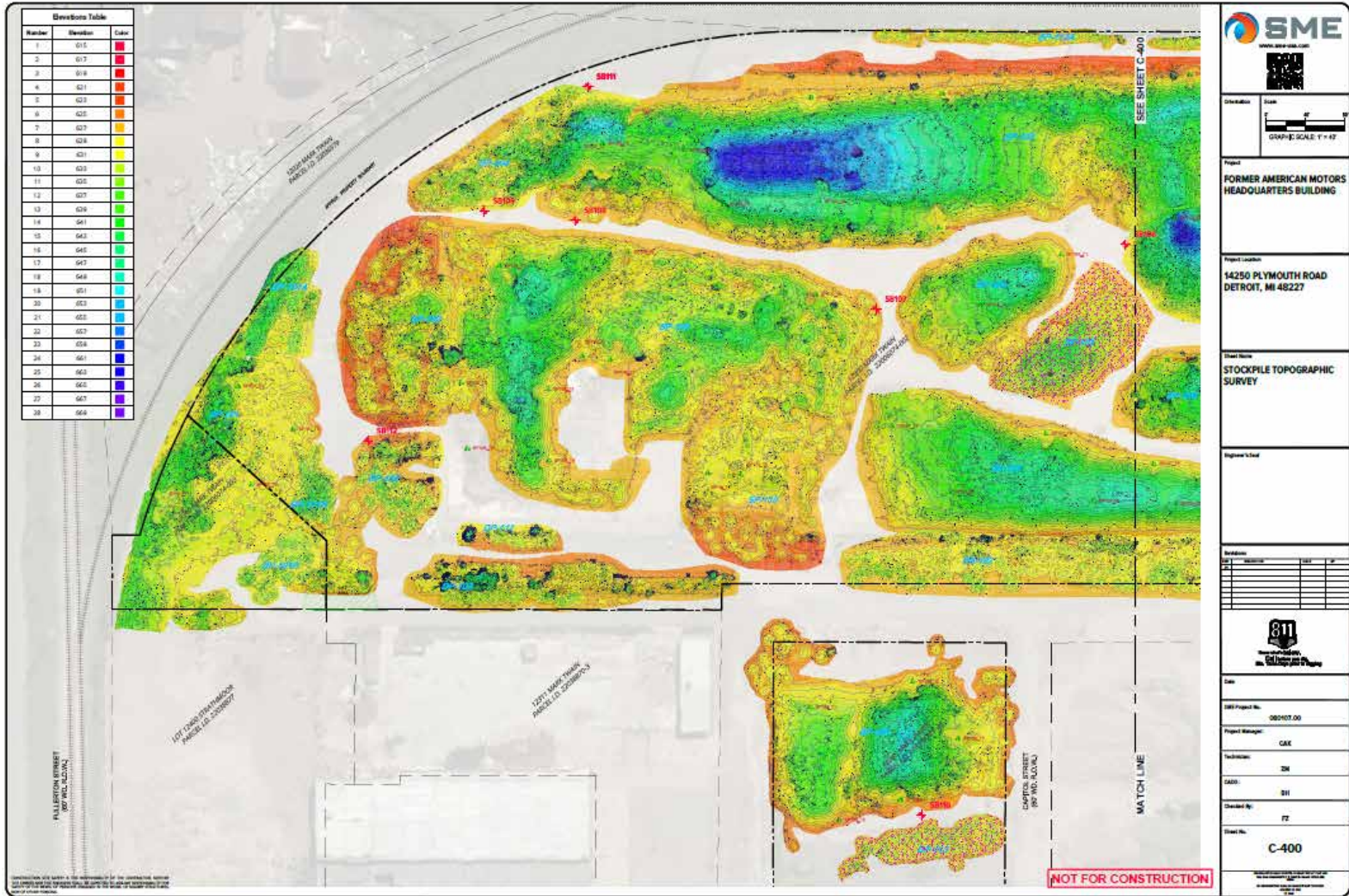
CADD: BH

Checked By: FZ

Sheet No.: C-100

- Site Survey
- Volume Calculations (stockpiles)
- Condition Assessments
- Slope Stability (LiDAR)

Stockpile Topographic Survey



Topographic Survey and Stockpile Quantities



- EXISTING LEGEND**
- CONTOUR
 - NEED CONTROL
 - APPROX. BOUNDARY
 - SOIL ASSES
 - FLY FILL
 - DIRT FILL
 - CONCRETE W/ FILL
 - ASPHALT PAVERING
 - LOT AREA

NOTE
SEE SHEETS C-458 THRU C-462 FOR FILE SURVEY DETAILS

| APPROX. SOIL PILE QUANTITIES | |
|------------------------------|---------------|
| PILE I.D. | QTY (CY) (±) |
| SP 101 | 27,200 |
| SP 102 | 4,660 |
| SP 103 | 1,000 |
| SP 107 | 21,000 |
| SP 108 | 11,000 |
| SP 110 | 1,400 |
| TOTAL | 66,260 |

| APPROX. CONCRETE PILE QUANTITIES | |
|----------------------------------|---------------|
| PILE I.D. | QTY (CY) (±) |
| SP 101 | 2,700 |
| SP 102 | 4,700 |
| SP 106 | 2,300 |
| SP 108 | 16,600 |
| SP 111 | 300 |
| SP 113 | 110 |
| SP 114 | 600 |
| SP 104 | 380 |
| DP 109B | 300 |
| DP 102C | 200 |
| DP 102 | 100 |
| DP 103 | 1,210 |
| DP 104 | 1,070 |
| DP 105 | 4,100 |
| DP 107A | 2,900 |
| DP 107B | 1,800 |
| DP 107C | 300 |
| DP 110 | 30 |
| DP 111 | 300 |
| DP 112 | 80 |
| DP 113 | 400 |
| TOTAL | 46,700 |

| APPROX. CONCRETE W/ FILL PILE QUANTITIES | |
|--|--------------|
| PILE I.D. | QTY (CY) (±) |
| SP 103A | 100 |
| SP 103B | 110 |
| SP 103C | 910 |
| SP 103D | 400 |
| SP 104 | 1,000 |
| SP 108 | 90 |
| SP 107 | 200 |
| TOTAL | 2,910 |

| APPROX. CONCRETE W/ FILL PILE QUANTITIES | |
|--|--------------|
| PILE I.D. | QTY (CY) (±) |
| SP 103A | 100 |
| SP 103B | 110 |
| SP 103C | 910 |
| SP 103D | 400 |
| SP 104 | 1,000 |
| SP 108 | 90 |
| SP 107 | 200 |
| TOTAL | 2,910 |

NOT FOR CONSTRUCTION

PARCEL DATA

NOTE: PARCEL DATA OBTAINED FROM CITY OF DETROIT GIS WEBSITE

PARCEL NO. 220590741
ADDRESS 12510 MARK TAWN
ZONING M6
ACRES 13.877

LEGAL DESCRIPTION
W 6 1/4 CORNER 1/4 OF 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
AT A P & B 0.1386 MARK TAWN AND 0.4215 100' DIA. CURB
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
PL 10/24/06 101

PARCEL NO. 220590740
ADDRESS 12510 MARK TAWN
ZONING M6
ACRES 13.888

LEGAL DESCRIPTION
W 6 1/4 CORNER 1/4 OF 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
AT A P & B 0.1386 MARK TAWN AND 0.4215 100' DIA. CURB
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
PL 10/24/06 102

PARCEL NO. 220590743
ADDRESS 12510 MARK TAWN
ZONING M6
ACRES 0.803

LEGAL DESCRIPTION
W 6 1/4 CORNER 1/4 OF 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
AT A P & B 0.1386 MARK TAWN AND 0.4215 100' DIA. CURB
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
PL 10/24/06 103

PARCEL DATA

NOTE: PARCEL DATA OBTAINED FROM CITY OF DETROIT GIS WEBSITE

PARCEL NO. 220590740
ADDRESS 12510 MARK TAWN
ZONING M6
ACRES 2.204

LEGAL DESCRIPTION
W 6 1/4 CORNER 1/4 OF 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
AT A P & B 0.1386 MARK TAWN AND 0.4215 100' DIA. CURB
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
PL 10/24/06 104

PARCEL NO. 220590741
ADDRESS 12510 MARK TAWN
ZONING M6
ACRES 1.848

LEGAL DESCRIPTION
W 6 1/4 CORNER 1/4 OF 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
AT A P & B 0.1386 MARK TAWN AND 0.4215 100' DIA. CURB
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
PL 10/24/06 105

PARCEL NO. 220590743
ADDRESS 12510 MARK TAWN
ZONING M6
ACRES 1.921

LEGAL DESCRIPTION
W 6 1/4 CORNER 1/4 OF 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
AT A P & B 0.1386 MARK TAWN AND 0.4215 100' DIA. CURB
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
100' W 1/2 CORNER 1/4 SEC 17 T 18 N R 11 E 3088 AS MD
PL 10/24/06 106

NOTES

1. DRAWING BASED ON MICHIGAN STATE PLAN COORDINATES SYSTEM. ELEVATION INFORMATION NOT SCALED TO GRIDLINE.
2. THIS SURVEY WILL NOT SHOW ALL DIMENSIONS OF EXISTING UTILITIES. ANY UTILITIES THIS POLITY HAS BEEN FURNISHED TO THE SUBMITTER BY THE OWNER.
3. ALL DIMENSIONS ARE BENCHMARKED.
4. PROJECTS ARE LOCATED IN CLOSE PROXIMITY TO EXISTING FLOODING. THE FLOOD HAZARD RPT MAPS INDICATE THE FLOODING DATES 2003-10-19 DRAINAGE DISTRICT.
5. NO BOUNDARY SURVEY PROVIDED. APPROXIMATE BOUNDARY SHOWN WAS OBTAINED FROM MAINE COUNTY GIS DATA.
6. AT TIME OF SURVEY, OBTAINERSHIP OF VEGETATION WAS OBSERVED OVER SOLE SOURCE DATA.
7. NO UTILITY INFORMATION IS SHOWN.

BENCHMARK DATA

BM 1
SP 102 W/ MARK TAWN
ELEVATION 1453.20
BENCHMARK DATA

BM 2
SP 102 W/ MARK TAWN
ELEVATION 1452.17
BENCHMARK DATA

BM 3
SP 102 W/ MARK TAWN
ELEVATION 1452.11
BENCHMARK DATA

BM 4
SP 102 W/ MARK TAWN
ELEVATION 1452.11
BENCHMARK DATA

CLIENT

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2000000000 TRUMP
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CONTACT: CLEVELAND DALRY

WARNING!
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CONTRACTORS ARE ALERT TO THE IMPROVEMENT OF THE CONSTRUCTION PROCESS THROUGH THE USE OF TECHNOLOGY. THE USE OF TECHNOLOGY IN THE CONSTRUCTION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND SECURITY OF THE CONSTRUCTION PROCESS.

Division: Survey
Scale: 1" = 100'
GRAPHIC SCALE 1" = 100'

Project: FORMER AMERICAN MOTORS HEADQUARTERS BUILDING

Project Location: 14250 PLYMOUTH ROAD DETROIT, MI 48227

Sheet Name: TOPOGRAPHIC SURVEY AND STOCKPILE QUANTITIES

Project No.: 080107.00

Project Manager: CAK

Technician: ZM

CAD: BH

Checked By: FZ

Sheet No.: C-200

DATE: 10/24/06

PROJECT: FORMER AMERICAN MOTORS HEADQUARTERS BUILDING

Available Deliverable Formats



- Ortho-Images
- Point Cloud
- AutoCAD ".dwg" files
- Conceptual Renderings
- Geo-Referenced PDF with project specific CAD overlays

Landfill Design & Operation

- Operational
 - Measure compaction rates
 - Perform volume & airspace calculations
 - Ensure that landfill is being built as designed
- Maintenance
 - Topographic surveys
 - Identify areas of erosion, low soil coverage, standing water
 - Methane monitoring

3D LASER SCANNING

3D Laser Scanning

Scanning Opportunities:

- Volumetric Surveys
- Building and Façade Evaluations
- Tank Calibration/Inspection
- Power Line Inspection/Clearance
- Utility Design Surveys
- Mine/Quarry Surveys
- Excavation Surveys

Technical Specifications

- Point Spacing
 - 6.25mm, 12.5mm, 25mm or 50mm @ 50m
- Accuracy
 - 3D Position Accuracy @ 100m = 2.5mm



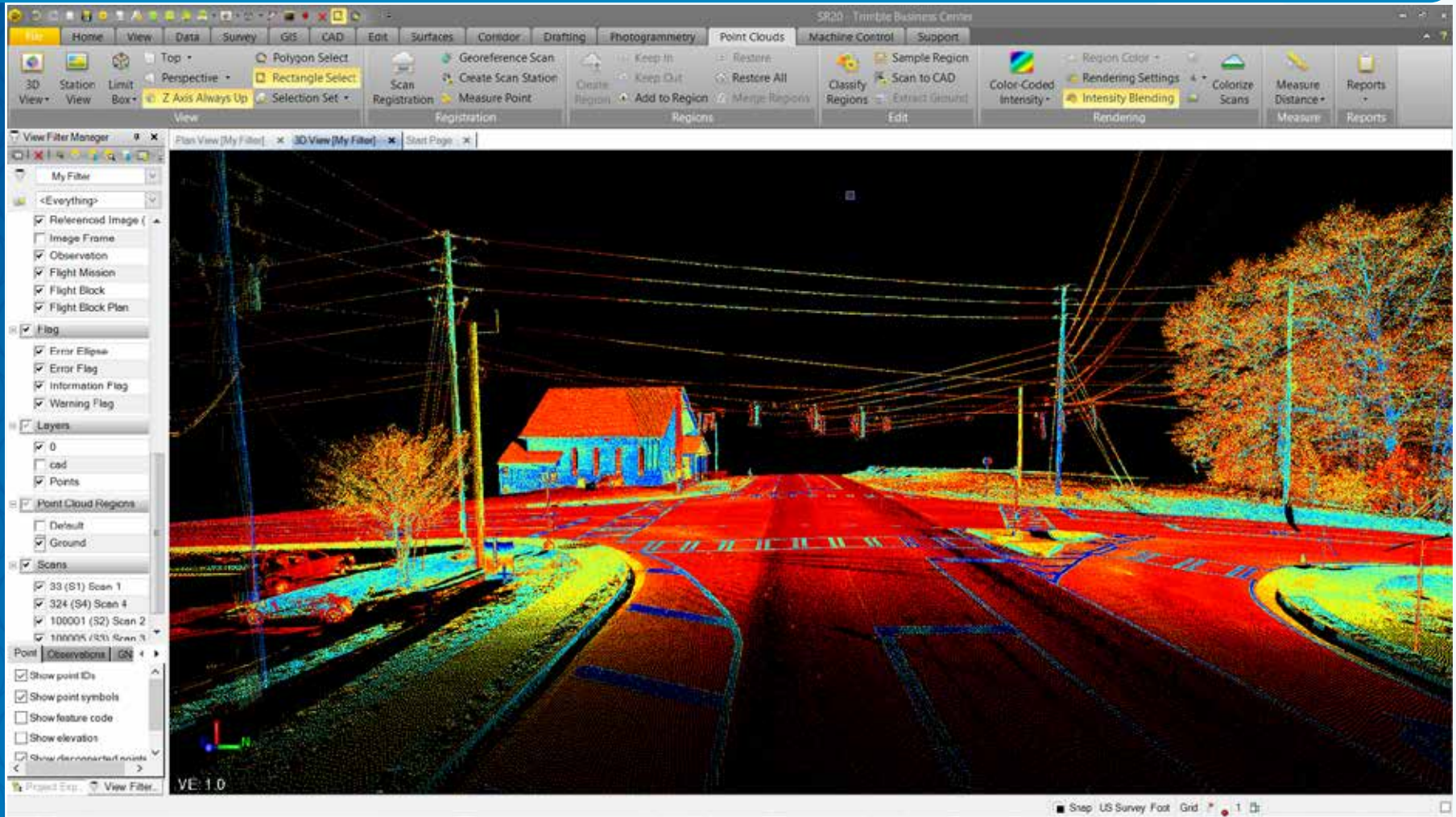
Scanning Total Station

Trimble SX10

- Higher cost
- Up to 600m range
- Accurate to 14mm at 100m
- Scans 26,600 points per second



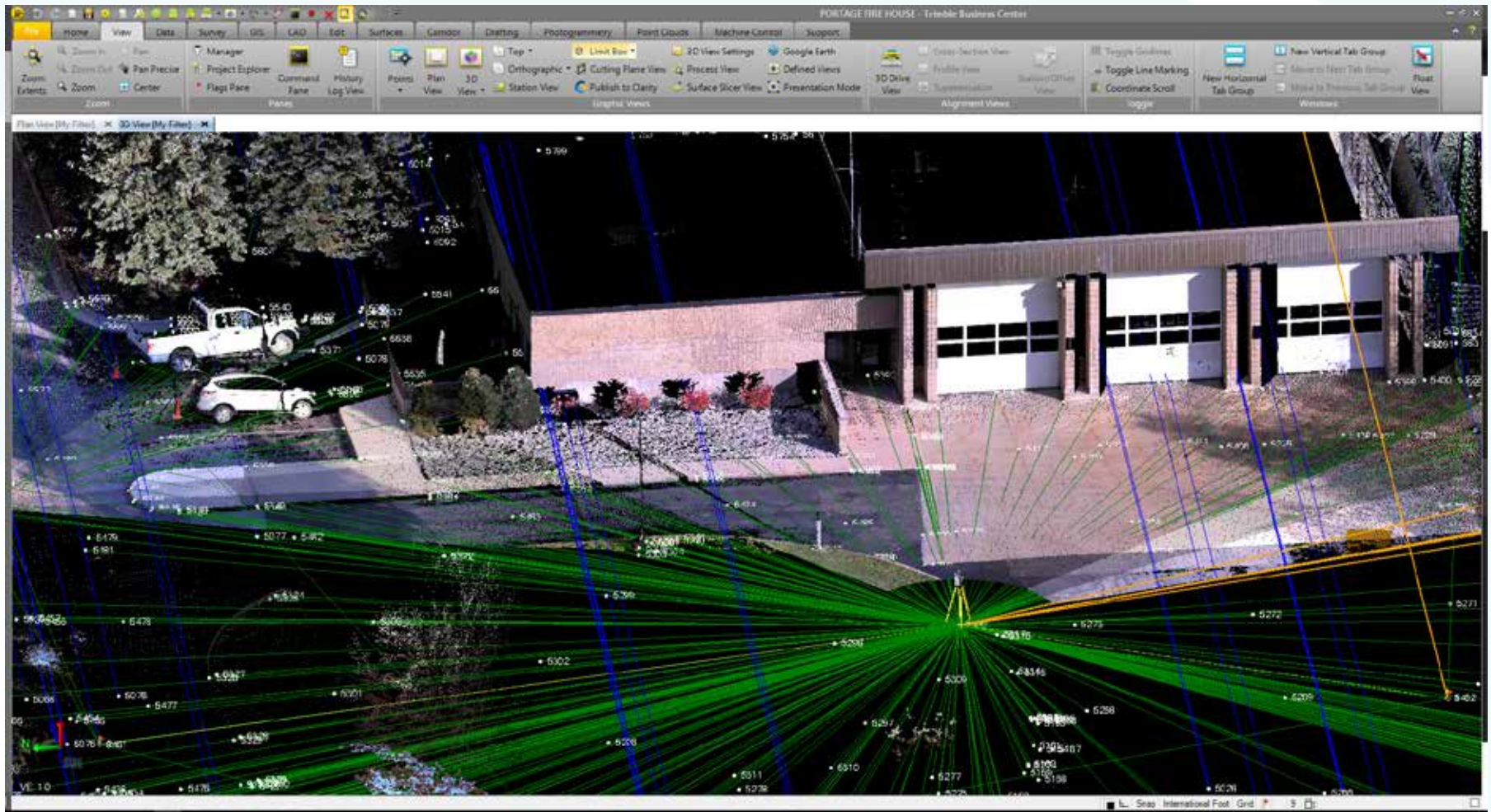
3D Laser Scanning



Laser Scan and Conventional Survey Data



3D Laser Scanning



Laser Scan and Conventional Survey Data



640 Temple Street Detroit, Michigan



640 Temple Street – Rooftop 3D Laser Scan



640 Temple Street – Rooftop Topo Survey



Remedial Excavations

- Tracking excavation progress
- Mapping sample points
- Oversight on material removal

Managing a Project? Some things to consider..

- Equipment
- Proximity of the Project Site to:
 - “No Fly” Zones
 - Pedestrian or vehicle traffic
- Weather
 - Seasons (winter would be bad for flying because of turbulent, thin cold air and higher winds.
- Staffing
 - Training and bill rates
 - Project planning
 - Time on site to perform the necessary preliminary work
 - Time in the office to perform necessary post processing
 - Dedicated staff to act as operator when necessary
- 2:1 ratio of office to field time.
 - Processing higher quality grade data is ideal because it minimizes field time and maximizes the return.
 - The cost of that is that much more time is needed in the office to sort through the data and make it usable.

Limitations

- Controlled Airspace – FAA Regulations
- Part 107 Limitations
 - Beyond VLOS, daylight, not over people
- Regulatory interpretations
- Differing safety concerns
- Privacy concerns
- Weather
 - Time of day (mid-day is best)
 - Conditions (visibility, cloud cover, snow, rain, fog)
 - Winter months = poor conditions
- Batteries!!!
- Personnel – Need to be FAA Certified or under direct supervision

Questions?