

# S.C.A.N.S

## HIGH DEFINITION LASER SCANNING

### A VIABLE SURVEY ALTERNATIVE

#### I-4/SELMON EXPRESSWAY INTERCHANGE

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 Dan Adams, CST/PBS&J

## WHAT IS THE CONNECTOR ?

- Multi-level System to System Interchange
- Important Regional Link and Part of the Tampa Interstate Study
- Provides Connectivity from the Lee Roy Selmon Expressway to I-4
- Collaborative effort between FDOT, THEA, and FTE
- Toll Facility





## PROJECT COSTS

Project Phase	Tentative WP 2008-2013
Right-of-Way	\$ 77,800,000
Design	\$ 68,200,000
Construction*	\$ 487,900,000
Totals	\$633,900,000

\*Includes \$17,000,000 for THEA deck panel replacements

## SCOPE OF WORK

- **SR 618 Bridge Reconstruction**
  - 39<sup>th</sup> Street WB
  - 26<sup>th</sup> Street EB and WB
- **SR 618 Bridge Widening**
  - 22<sup>nd</sup> Street EB and WB
- **SR 618 Bridge Deck Panel Replacements**
  - CSX WB
  - 34<sup>th</sup> Street WB

## SCHEDULE

- **Phase II – December 2006**
  - **Phase III – June 2008**
  - **Phase IV – November 2008**
  - **Final Plans – February 2009**
  - **Letting – October 2009 (May be Expedited)**
- 
- **Scanning Partnership – September 2006**
  - **Field Work – February through May 2007**

# FDOT PILOT PROJECT

## “PARTNERING APPROACH”



# PARTNERS AND ROLES

- **CENTRAL OFFICE FDOT:**  
PCs & LAPTOPS, SOFTWARE, MISC. EQUIPMENT
- **DISTRICT 4 FDOT:**  
OPERATOR AND SCANNER & MISC. EQUIPMENT
- **DISTRICT 7 FDOT:**  
FIELD CREWS, MOT ASSISTANCE, HIGHWAY  
MAINTENANCE/CSX RAILROAD COORDINATION,  
TRAVEL COORDINATION FOR DISTRICT 4
- **PBS&J:** FIELD SUPERVISOR, PROJECT  
COORDINATION, HORIZ & VERTICAL CONTROL,  
SCANNING SUPPORT AND PROCESSING, CADD  
DELIVERABLES & PROJECT ANALYSIS



## ORIGINATION & BACKGROUND

- Discussions began in mid 2006
- Conventional Surveying vs. Laser Scanning
- Project Schedule, **Safety Issues**, Level of Detail



## MAINTENANCE OF TRAFFIC TRAINING\*

DOT District 7 MOT responsibilities:

- Provided DOT trained personnel w/ equipment to maintain traffic during the laser scanning operation
- Provided MOT contractor during lane closures (Digital Traffic Systems, Inc.)
- Coordinated w/ DOT Maintenance & THEA, to close expressway lanes w/ strict time constraints

\*Topic No. 625-010-010c (Most of you should be familiar with this)



**SURVEY CREW AHEAD**

Citrus  
Hernando  
Hillsborough  
Pasco  
Pinellas

**[CSX]** How tomorrow moves

**DTS** HOME PAGE

**Don't risk working in FDOT roadways without the proper MOT certification!**

**It seems to be everywhere!**

**Scanning Easter Island's Moai**

**Technology & more**

**IRONCLAD**  
Laser Scanning  
Technology

**measuring MARVELS**

**PROFESSIONAL SURVEYOR**





**3D scanning** | by Rob Duranczyk

## High Density Laser Scanning Preserve a Historic

This summer, land surveyors joined an impressive list of visitors to the historic Belleair Blinn Hotel in Belleair, Florida. The famous West Florida landmark, constructed in 1897, has hosted U.S. presidents, business tycoons, and celebrities throughout its history. The 440,000-square-foot Victorian style hotel, purportedly the world's largest occupied wooden structure, was placed on the National Register of Historic Places in 1979. In 2004, the hotel's 110-year existence was threatened with the possibility of demolition. Public opposition to destruction of the local landmark generated much attention, and in 2005 the National Trust for Historic Preservation placed the hotel at number 13 on its list of most endangered historical places.

Preservation of historic build...



▲ 3D laser scanning data of the Tiffany Ballroom




▲ Scanning the Tiffany Ballroom. Operations were conducted at night to disrupt guests as little as possible.

*"By combining an unusual multidiscipline team of professionals, the first phase of restoring ...the hotel has been completed with much success. Unique and challenging opportunities were presented to all parties involved with the high density laser scanning process, but Wade Trim specifically embraced and successfully used new, cutting edge technologies in order to collect vital data that will serve as the basis for the historic hotel's restoration for years to come."*

**Rob Duranczyk, PS manages and coordinates the L.S. services in Tampa , FL (888) 499-9624**

# ANCIENT HISTORY

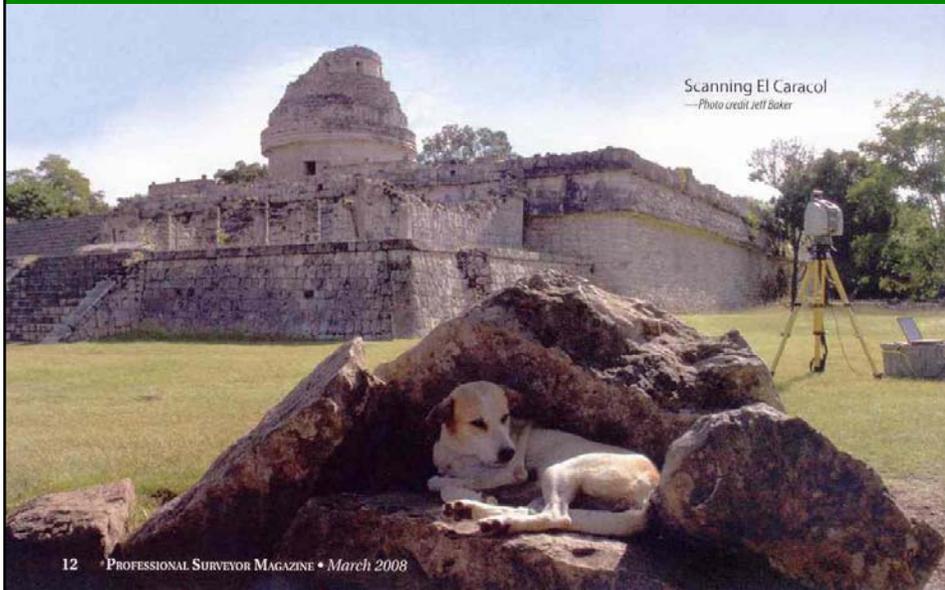


## Meets New Technology

Documenting Mayan ruins in Mexico with laser scanning makes for an enchanting and rewarding experience.




# It's almost a dog's life...to laser scan



3D scanning | by Bruce Jenkins

## Laser Scanning the I-35W Bridge Collapse: Minnesota DOT's Story

All images courtesy Minnesota Department of Transportation



▲ Laser scanning some of the most severe I-35W wreckage



## AERIAL PERSPECTIVE

### 3D Scanning and Data Fusion: Making It Work

Darrell Nance, PLS

There are many compelling reasons to add laser scanning to your organization's resume. For BRH (Bush, Roed & Hitchings, Inc.), a mid-size land surveying and civil engineering firm located in Seattle, Washington, considering the purchase of a laser scanner involved a lot of introspection. Ultimately, our decision to acquire our first scanner was based on these factors:

- Safety
- The power of the software
- The possibility of capturing a niche in the market
- Our view that this technology represents the direction that surveying technology in general is headed
- The "cool" factor (okay, not the best reason, but our clients love to see how this stuff works!)

With owners and design teams increasingly using 3D design tools, providing survey data in true 3D is becoming more important.

Like a lot of firms who use scanning, we tend to use it for specific projects. We are increasingly working it into our regular schedule, but there are some projects for which the scanner is clearly best suited. The following are some examples.



## Some Interesting Pros

- Conducive to DOT work
- Reduced risk of "Re-Dos"
- Cost/Benefits
- More Detail in Less field time
- OK with "Scope creep"
- Customer/User Satisfaction
- Declining "start up" costs
- Evolving technology
- Safer Work Environment



## Some Challenging Cons



- Startup costs / equipment
- Staff commitment / training
- Marketing client buy-in
- Staying competitive
- Keeping up with state-of-the-art technology

## Lee Roy Selmon Expressway



## PROJECT SPECIFICS

Dianne M. Collins, PLS/DRMP

### BRIDGE SURVEY- SCOPE OVERVIEW

Seven Bridges Total for Survey Project – Typical Tasks

- Bridge Deck Elevations – Gutter lines, joints, CL piers and at Mid-Spans
- Station and offset to Bridge Joints and CL Piers at the Gutter Lines
- Beams – Center to Center; Fascia Girder to Pier Cap; Fascia Girder to Coping
- Columns – location and size
- Vertical – Clearance above Pavement, Curbing and Railroad
- Approach Slabs – Horizontal and Vertical on Slabs plus 300'

## PROJECT COSTS

### Conventional Survey Cost Estimate

Field Crew – 144 days =	\$223200
Office Support/CADD - 464 hrs =	\$ 50112
Bucket Truck Rental – 50 Days =	\$ 16000
Project Management – 50 hrs =	\$ 7250
QA/QC – 50 hrs =	\$ 5050
Contingency (Typically 10%) =	\$ 30161
<b>TOTAL</b>	<b>\$331773</b>

## PROJECT COSTS

### Laser Scanning Actual Cost

Field Crew – 19 days =	\$ 29450
CADD – 450 hrs =	\$ 45450
Prep/Coord/Sup – 40 hrs =	\$ 4600
Scan Hours – 258 hrs =	\$ 29670
Processing – 212 hrs =	\$ 24380
Project Management – 50 hrs =	\$ 7250
QA/QC – 200 hrs =	\$ 20200
Misc. FDOT (MOT, Crew/Tech Labor/Scanner) =	\$ 47880
<b>TOTAL</b>	<b>\$208880</b>

## PROJECT COSTS

### COMPARISON

Conventional Survey	\$331773
Laser Scanning	\$208880
Difference	\$122893

COST SAVINGS 37%

## PROJECT SCHEDULE

### Conventional Surveying Schedule Estimate

Field Crew -	117 days
Office Hours (CADD/PLS) -	464 hours
<b>TOTAL -</b>	<b><u>9 months from start to final deliverable</u></b>

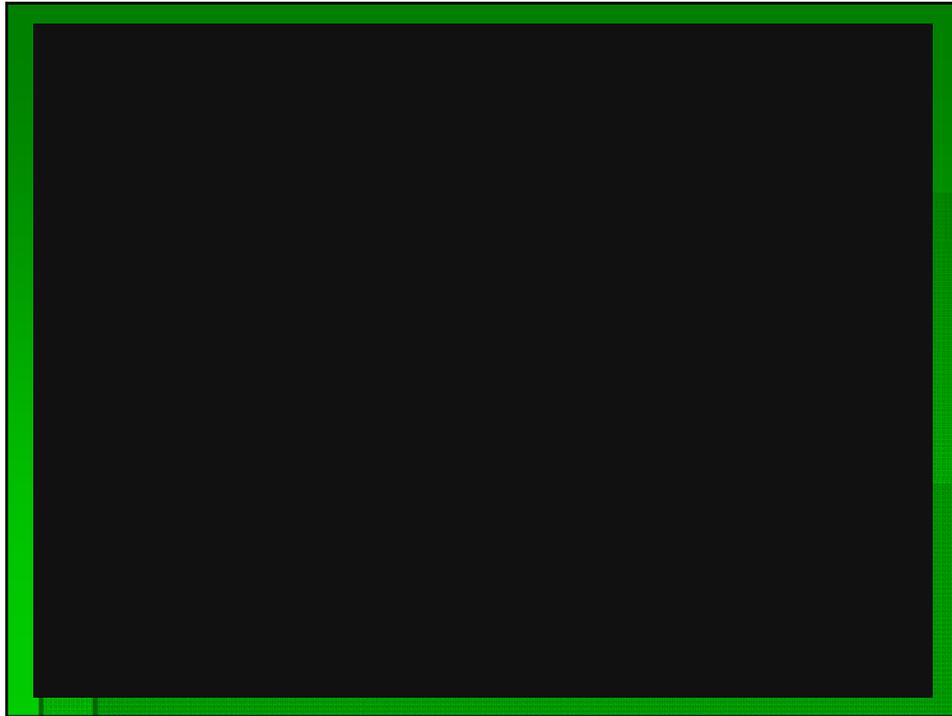
### Laser Scanning Actual Schedule

Field Crew Control -	15 days
Scanning -	26 days
Office Hours (CADD/PLS/QC)-	650 hours
<b>TOTAL -</b>	<b><u>4.5 months from start to final deliverable</u></b>

## PROJECT WORKFLOW

Field Process:

- Establish Horizontal and Vertical Control
- Establish Scanning Schedule with District 4 (initially every other week)
- Meet with Bridge Engineers On-Site
- Revise and Add Control and Targeting for New Requirements
- Discover and Resolve Scan Registration Issues
- Obtain MOT Permit for Bridge Decks and Approaches



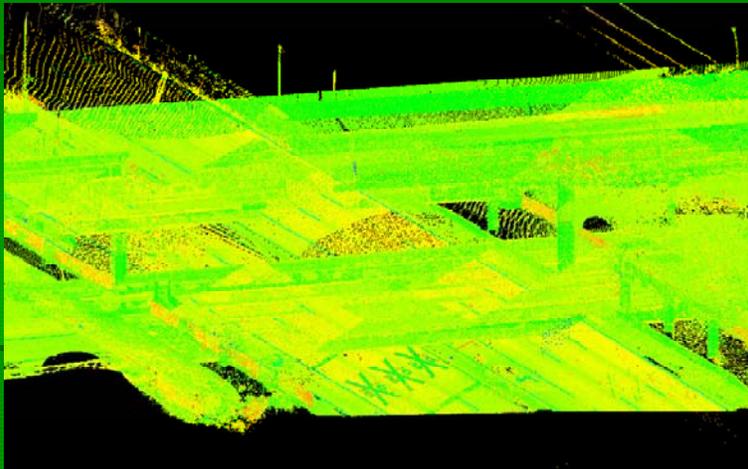
## PROJECT WORKFLOW

Office Process:

- **Process/Register Scans during off-field weeks**
- **Scanworlds fully registered and QC'd**
- **Point Cloud Files Cleaned Up**
- **Planimetric and Digital Terrain Model CADD files developed, QC'd and delivered**

# WORK PRODUCT

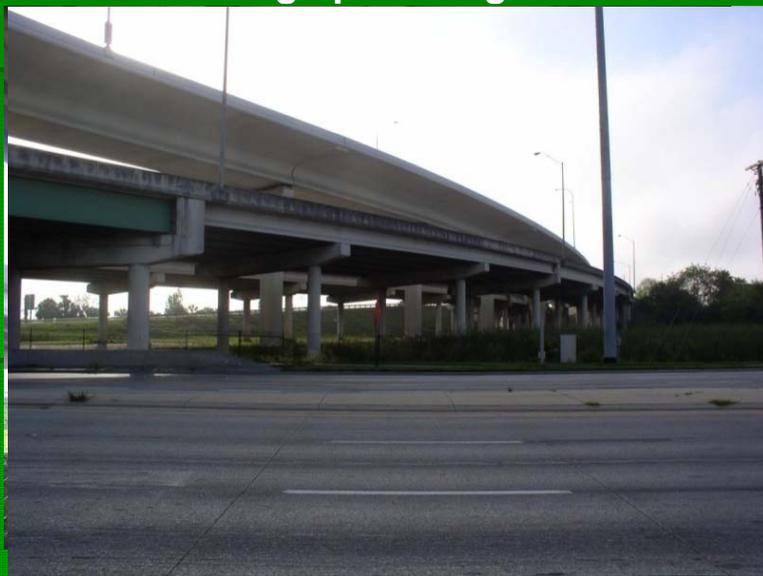
## Scanned Images



22<sup>nd</sup> Street Isometric View  
Scanned Point Cloud

# WORK PRODUCT

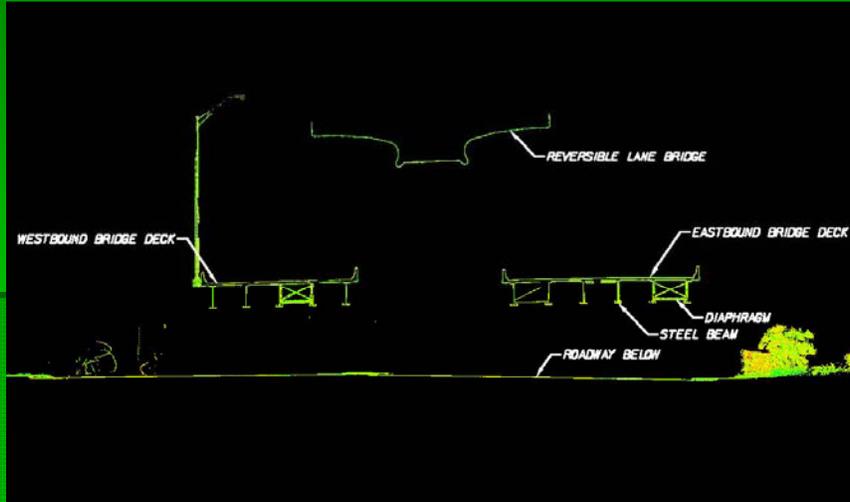
## Photographic Images



# WORK PRODUCT

Scanned Images and Photography:

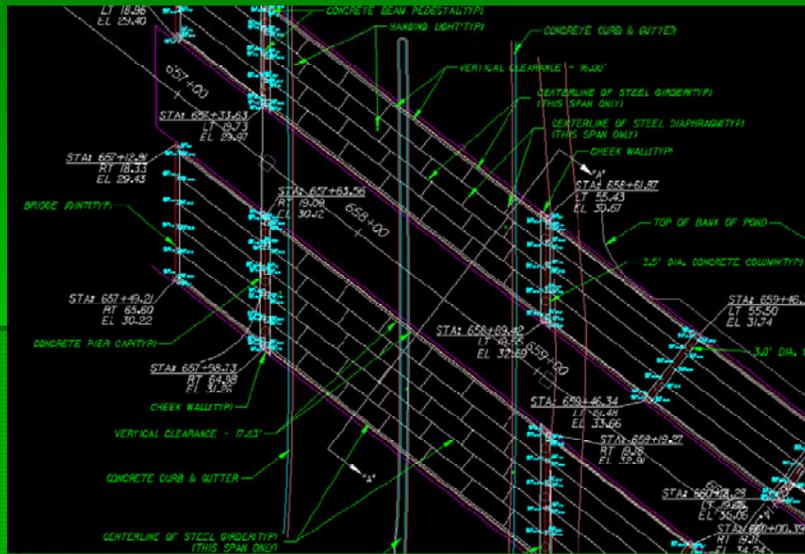
22<sup>nd</sup> Street – Slice from the Point Cloud



# WORK PRODUCT

CADD Work Product

22<sup>nd</sup> Street CADD Snapshot



# WORK PRODUCT

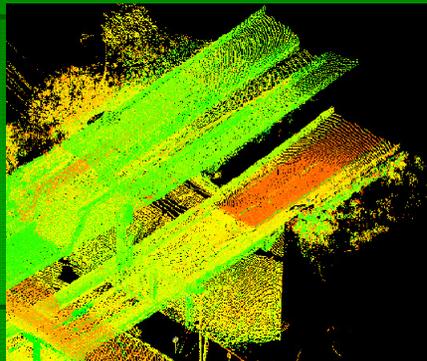
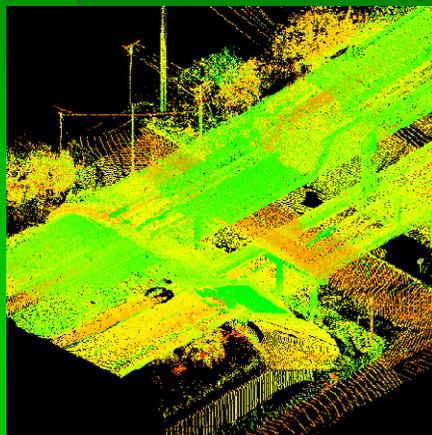
## 22nd Street CADD Details



# WORK PRODUCT

## Scanned Images

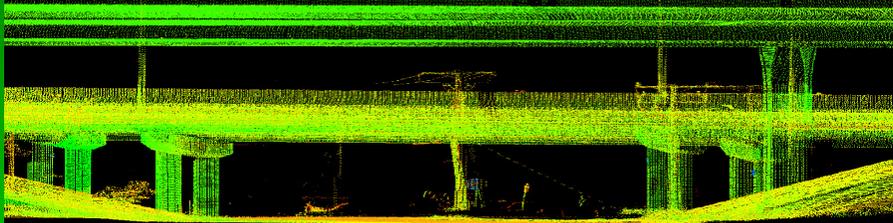
### 26th Street Isometric Views



# WORK PRODUCT

26<sup>th</sup> Street from Roadway

Scanned Image



Photograph



# WORK PRODUCT

Scanned Image

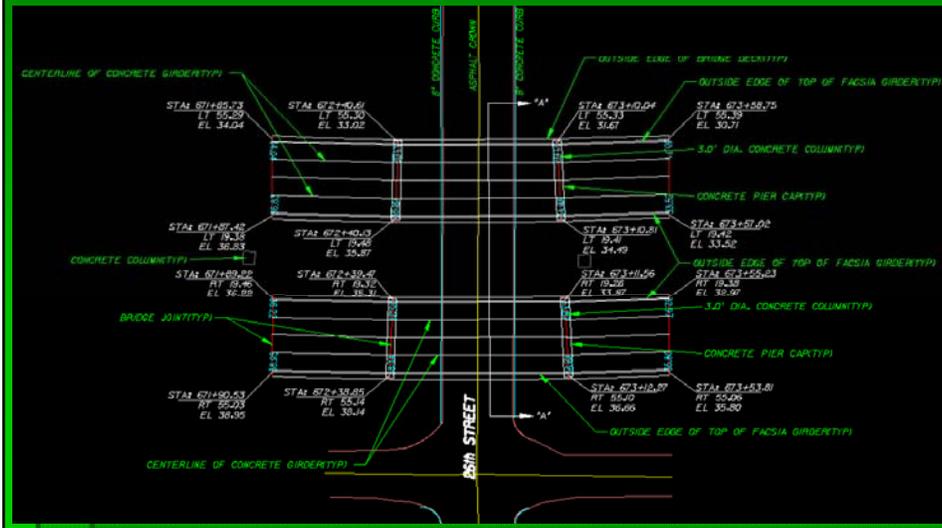
26<sup>th</sup> Street Pier Slice



# WORK PRODUCT

CADD Work Product

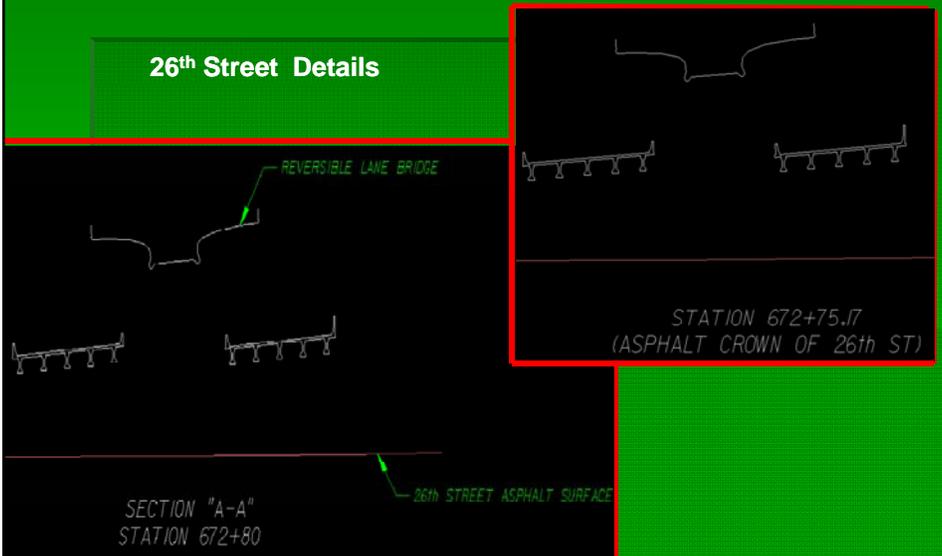
26th Street CADD Snapshot



# WORK PRODUCT

Data Extraction

26th Street Details



## WORK PRODUCT

### On-Going Data Retrieval

#### Typical Design Requests:

- **Surface Utility Specifics**
  - **DTM Surfaces**
    - **Elevations and Vertical Clearances**
  - **Traffic Sign Locations**

## WORK PRODUCT

### On-Going Data Retrieval

#### Cost Savings:

Technician

or

Field Crew + Associated  
Operational Costs

#### Schedule Savings:

Data Available  
At a Fingertip

or

Develop Scope  
Negotiate Hours  
Execute Supplemental  
Perform Field Work  
Process and Provide Data

**Which scenario would YOU prefer?**

## WORK PRODUCT

### On-Going Data Retrieval



## RESULTS/CONCLUSIONS

### End User Commentary: Design Engineers

“The Eastbound 22nd Street structure was originally only a deck panel replacement. At about the 30% design THEA asked us to widen the bridge on each side. In order to do that we had to verify the location of the reversible lane piers. Data from the Scans was readily available for this increase in scope. “

“We were also able to accurately measure vertical distances of the elevated lanes which helped us design some special signs to fit in the limited clearance. We did not have to go back out there at least three separate times.”

“Worked fine for what we needed.”

**Bottom Line: No difference in Work Product – More data available with scanning**

## RESULTS/CONCLUSIONS

### Applications for Laser Scanning

- ✓ Bridges
- ✓ Intersection Improvement Projects
- ✓ Buildings – Exterior and Interior
- ✓ Accident Sites
- ✓ Industrial Facilities
- ✓ Site Monitoring

S.C H E D U L E

C.O S T

A.C C U R A C Y

I.N. N O V A T I O N

S.A F E T Y

THANK YOU!

Questions & Answers ?

