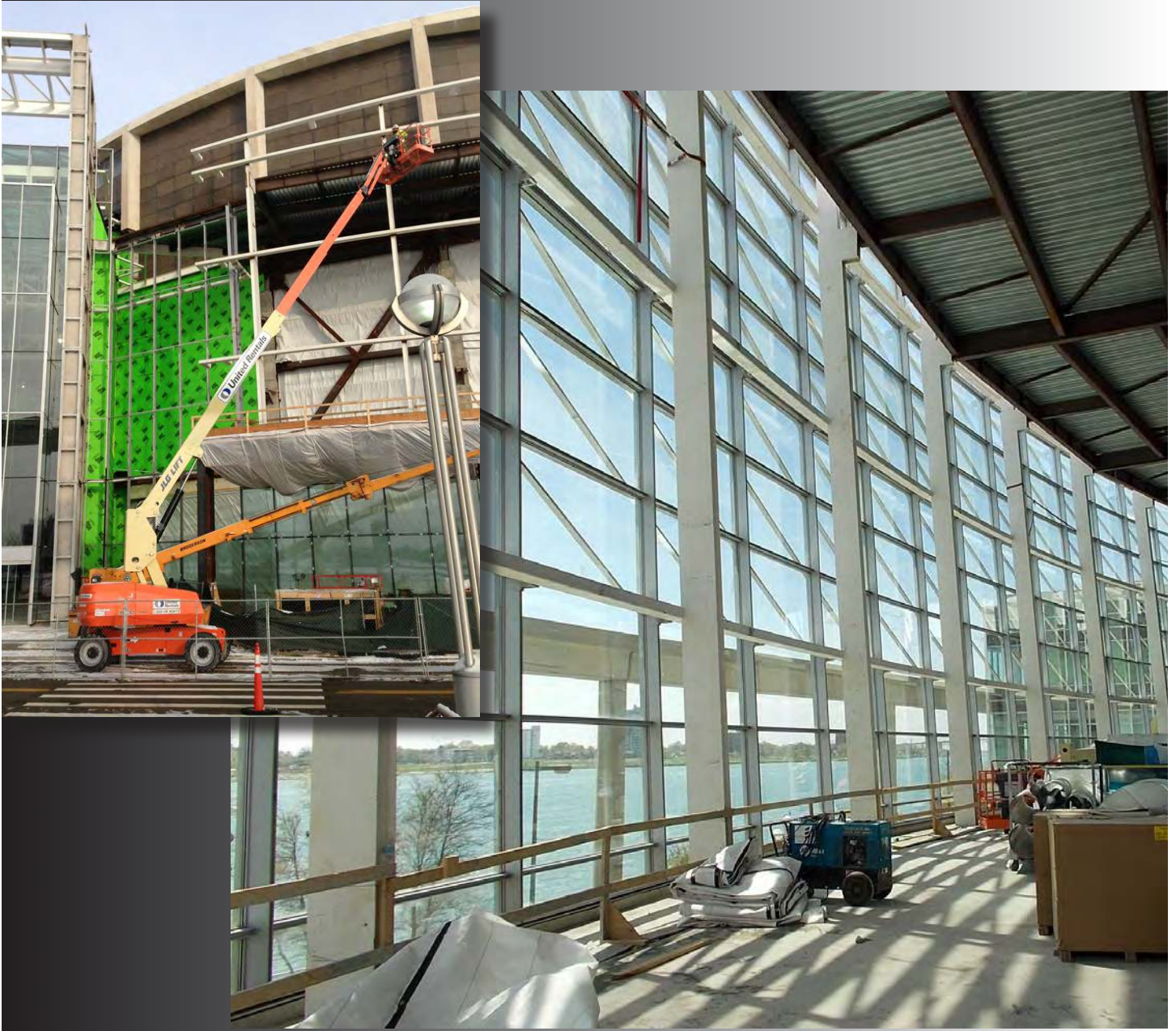


Surveying Specialty

# Layout for Industrial and Heavy Civil Projects





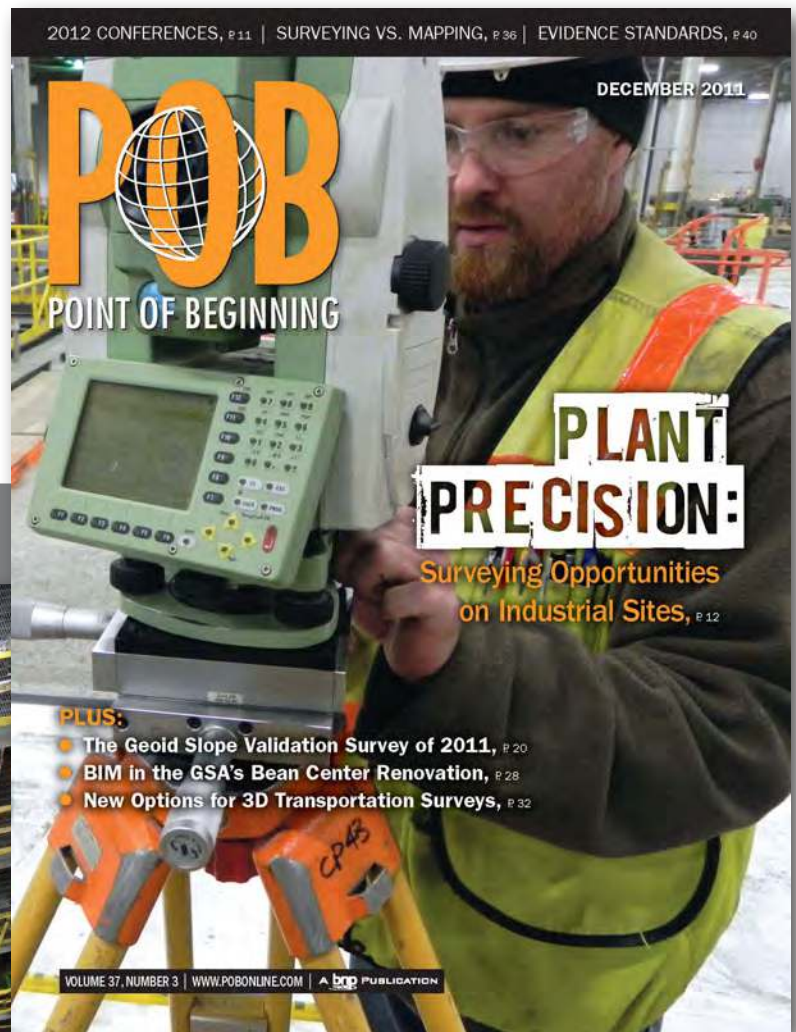
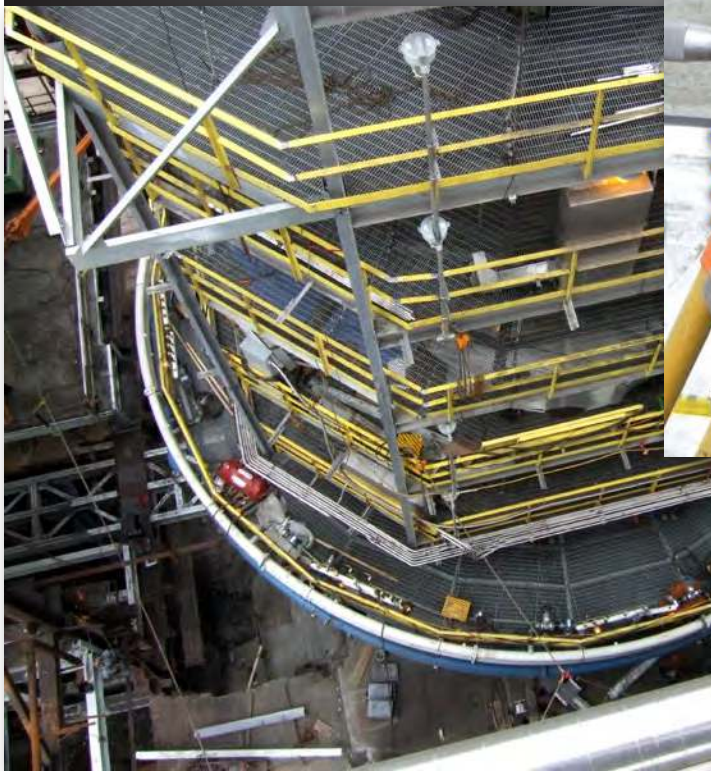
## Industrial Surveying

### Overview

Industrial surveying is sometimes used to describe the precise alignment of industrial machining or equipment and is also sometimes termed “optical tooling.” Although some overlap exists between this process and traditional surveying techniques, SDA primarily focuses on the precise surveying layout work that is required to set the foundation for a project before the millwrights, boilermakers, machine installers or toolmakers take over to perform the final measurements and installation. In these types of applications, surveyors are often followed by other professionals who use tilting levels, laser trackers, and other measurements to achieve sub-millimeter accuracy.

Projects for manufacturing plants, steel mills, refineries, and power plants comprise the bulk of our industrial work. Owners include automotive companies and suppliers, defense manufacturers, energy producers, and steel makers. Services involve providing layout for installing process line support steel in existing facilities; setting control for process or assembly lines; layout for piles, footings, piers, foundations, and anchor bolts for new construction; layout for architectural metal or screen-wall assembly for buildings; anchor-bolt and steel-erection surveys; crane rails surveys; coal volume surveys; and verification and as-built surveys. The common thread between these projects is the large scale of the construction, the exacting tolerances required, and the relative complexity of the projects and plans.

Industrial sites require stringent safety practices, exacting tolerances, and attention to detail.



Spalding DeDecker's Industrial Surveying practice was featured as the cover story for Point of Beginning (POB) magazine, a national publication for the surveying industry.

SDA crews performed extensive layout and as-built measurements, on a new blast furnace at the former Rouge Steel site, including the check of each irregular-shaped piece of the assembly to extremely tight tolerances.

## Industrial Surveying



Spalding DeDecker Associates, Inc. (SDA) has performed several different types of projects across the United States. Some of the services we have provided include:

### Architectural Metal and Screen Wall Layout

Modern building construction often includes a structural steel framework to support the building and a modular screen wall to encapsulate the structure and provide architectural highlights. Precise layout is required to assure that the various panels are plumb and aligned in all planes. Alternating windows and building panels typically leave very little room for error, with little allowance provided for variations in spacing. Because line of sight from one panel to the next is an aesthetic issue, it is critical that all joint lines are precisely aligned. All of this demands precise, exacting tolerances for surveying layout and specialized techniques.

SDA is experienced in working on projects with a variety of construction elements, including architectural metal, glass, pre-manufactured panels, and other details.

### Layout for Plant Process Lines

Process equipment such as paint lines within a paint shop require support steel located along the line. This support steel is typically attached to the concrete plant floor by drilling holes and setting quick-set bolts or anchoring the bolts with epoxy. This task typically requires the precise layout for dozens of columns and hundreds of individual bolts.

### Coal Volume Surveys

Power plant operators require accurate volume surveys on a regular basis in order to confirm their usage computations versus their delivery records and actual remaining volumes. Because the volume of coal varies greatly depending on the type, source, and method of stockpiling, reconciling the calculations can be a challenge and having accurate measurements is critical.

SDA is able to use conventional surveying measurements, laser scanning, or automated methods to accurately compute coal stockpile volumes.



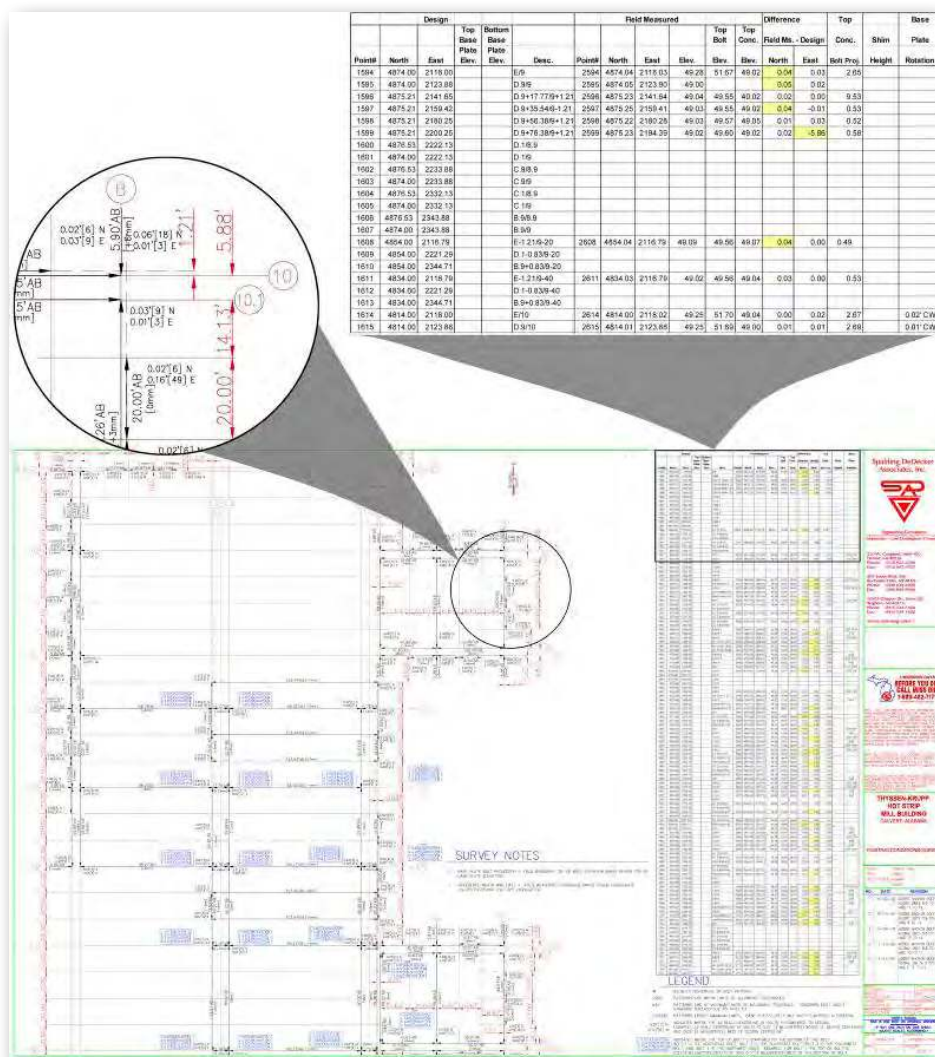
## Industrial Surveying

### Anchor Bolt As-Built

#### Measurements and Drawings

As-built surveys of anchor bolts are typically requested prior to beginning steel-erection. These surveys are critical to spotting problems while there is time to make corrections. Correcting these problems in advance helps to avoid costly down time and scheduling issues during the steel-erection process.

SDA typically verifies furnished site control and locates the centerline of each bolt pattern. We then calculate the offset of the as-built column in relation to the proposed centerline, the measured distance between bolt patterns, the bolt projection, and the top of concrete elevation. Additional measurements can be made to determine the orientation of the bolt patterns to determine if they are skewed in relation to the column lines. For larger bolt patterns, templates can be made for a test fit of bolts to spot problems early on if bolts are leaning or incorrectly spaced. Results are typically presented in a drawing and spreadsheet format.



## Industrial Surveying

### Layout and As-Built Locations for Crane Rail

Crane rail installation typically requires exacting specifications for horizontal and vertical alignment. SDA provides layout, as well as as-built measurements and drawings to support this precise work. Depending on the type of system installed, this critical work may begin with assistance in installing the support columns and crane girders. SDA provides reports relative to standards of the Crane Manufacturer's Association of America (CMAA) for rail span, straightness, elevation, and eccentricity. This includes evaluating direct measurements as well as the rate of change.

### Supplemental Layout for Steel Erection

Supplemental layout may include establishing the bottom of base plate elevations by setting shims or setting one leveling nut to the proposed elevation. For structural steel that requires precise alignment, we have also provided assistance in plumbing individual columns. In some applications we have also provided horizontal and vertical alignment for crane girders. All these steps are critical for the final crane rail installation, assuring that proper eccentricity is achieved, meaning that the rail is centered on the crane girder.

Hot Strip Mill - Runway #7 Crane Rail Spans											
Between Columns: 15.1 & 15.9											
CMAA Allowable Span Tolerance: 0.25"											
CMAA Maximum Rate of Change: 0.25" in 20', 0.260" in 20.81' or 0.313" in 25'											
Column Spacing: 41.625 & 50 ft. Design Rail Span: 68.25 ft.											
Column No.	Design Span (in.)	Measured Span (in.)	Difference (in.)	Span Out of Tolerance	Rate of Change Out of Tolerance	Column No.	Design Span (in.)	Measured Span (in.)	Difference (in.)	Span Out of Tolerance	Rate of Change Out of Tolerance
B	819.00	819.978	-0.024	no	no						
Mid	819.00	818.780	-0.221	no	no						
B.5	819.00	818.819	-0.181	no	no						
Mid	819.00	818.919	-0.181	no	no						
B.8	819.00	818.858	-0.142	no	no						
Hot Strip Mill - Runway #7 Crane Rail Straightness											
Columns: 15.1 & 15.9											
CMAA Allowable Rail Straightness: $\pm 0.375"$											
CMAA Maximum Rate of Change: 0.25" in 20', 0.260" in 20.81' or 0.313" in 25'											
Column Spacing: 41.625 & 50 ft. Design Rail Span: 68.25 ft.											
Column No.	Baseline to Inside Fl Rail Offset (in.)	Baseline Rail Straightness (in.)	Rail Straightness (in.)	Rate of Change Out of Tol.	Measured Rail Span (in.)	Design Rail Span (in.)	Rail Straightness (in.)	Rail Straightness (in.)	Rate of Change Out of Tol.	Measured Rail Span (in.)	Design Rail Span (in.)
B	12	12.031	-0.031	no	818.978	2.584	819.000	0.024	no	no	no
Mid	12	11.719	0.281	no	818.780	2.584	819.000	0.221	no	no	no
B.5	12	11.719	0.281	no	818.819	2.584	819.000	0.181	no	no	no
Mid	12	11.781	0.219	no	818.819	2.584	819.000	0.181	no	no	no
B.8	12	11.656	0.344	no	818.858	2.584	819.000	0.142	no	no	no
Hot Strip Mill - Runway #7 Rail To Rail Elevation											
Between Columns: 15.1 & 15.9											
CMAA Rail Elevation Tolerance: $\pm 0.375"$											
CMAA Maximum Rate of Change: 0.25" in 20', 0.260" in 20.81' or 0.313" in 25'											
CMAA Rail to Rail Elevation Tolerance: $\pm 0.250"$											
CMAA Rail to Rail Elevation Rate of Change Tolerance: 0.26" in 20', 0.260" in 20.81' or 0.313" in 25'											
Column Spacing: 41.625 & 50 ft. Design Rail Span: 68.25 ft.											
Column No.	Design Elevation (ft.)	Measured Elevation (ft.)	Rail Elevation Difference (in.)	Rate of Change Out of Tolerance	Column No.	Design Elevation (ft.)	Measured Elevation (ft.)	Rail Elevation Difference (in.)	Rate of Change Out of Tolerance	Column No.	Design Elevation (ft.)
B	39.557	39.555	-0.024	no	B	39.557	39.570	0.156	no	B	39.557
Mid	39.557	39.555	-0.024	no	Mid	39.557	39.555	-0.024	no	Mid	39.557
B.5	39.557	39.560	0.006	no	B.5	39.557	39.565	0.096	no	B.5	39.557
Mid	39.557	39.555	-0.024	no	Mid	39.557	39.565	0.096	no	Mid	39.557
B.8	39.557	39.565	0.096	no	B.8	39.557	39.570	0.216	no	B.8	39.557
Hot Strip Mill - Runway #7 Rail Eccentricity											
Columns: 15.1 & 15.9											
Crane Rail Flange Width: 5.188"											
Web Thickness: 0.625"											
Allowable Rail Eccentricity: $3/4 \times$ Girder Web Thickness $\pm 0.469"$											
Column No.	Beam	o/s to Fl Web (in.)	o/s to Cl Web (in.)	o/s to Cl Rail (in.)	o/s to Fl Rail (in.)	o/s to Fl Rail (in.)	o/s to Cl Rail (in.)	o/s to Cl Rail (in.)	o/s to Fl Rail (in.)	o/s to Cl Rail (in.)	o/s to Fl Rail (in.)
B	Begin	11.563	11.875	9.438	12.031	0.156	no	8.750	9.063	6.750	9.344
Mid	11.315	11.625	9.125	11.719	0.094	no	8.688	9.001	6.563	9.156	no
End	11.375	11.688	9.125	11.719	-0.031	no	8.750	9.063	6.313	8.906	-0.156
B.5	Begin	11.625	11.938	9.125	11.719	-0.216	no	8.813	9.125	6.313	8.906
Mid	11.750	12.063	9.188	11.781	-0.281	no	8.750	9.063	6.625	9.219	0.156
End	11.815	12.125	9.063	11.656	-0.469	no	8.625	8.938	6.125	8.719	-0.219
Hot Strip Mill - Runway #7 Summary Columns 15.1 and 15.9 from Column B to B.8											
Column Spacing: 41.625 & 50 ft. Rail Span: 68.25'											
Item		Out of Tolerance									
Rail Span		All measurements are within allowable tolerances									
Span Tol.: $\pm 0.250"$											
Max Rate of Change: 0.313" in 25'											
Rail Straightness		All measurements are within allowable tolerances									
Straightness: $\pm 0.375"$											
Max Rate of Change: 0.313" in 25'											
Rail Elevation		All measurements are within allowable tolerances									
Rail Elevation: $\pm 0.375"$											
Max Rate of Change: 0.313" in 25'											
Rail to Rail Elevation: $\pm 0.250"$											
Max Rate of Change: 0.313" in 25'											
Rail Eccentricity		All measurements are within allowable tolerances									
Eccentricity: $\pm 0.469"$											

## Industrial Surveying

Following is a partial list of industrial projects we have performed throughout the United States:

**GM Service Parts Operations**

Swartz Creek, Michigan  
November, 2014 - December, 2014

**GM Arlington Assembly Plant**

Arlington, Texas  
June, 2014 - September, 2014

**Detroit Thermal Steam Service to GM**

Detroit, Michigan  
December, 2013 - May, 2014

**GM Lansing Grand River Assembly Plant**

Lansing, Michigan  
October, 2014 - present

**Subaru SIA Paint Shop 2**

Lafayette, Indiana  
June, 2014 - July, 2014

**Ford Kentucky Truck Stamping Plant**

Louisville, Kentucky  
December, 2013 - July, 2014

**BOSCH**

Plymouth, Michigan  
October, 2014 - December, 2014

**COBO Center Media Wall**

Detroit, Michigan  
May, 2014 - December, 2014

**NASA Mobile Launcher**

Cape Canaveral, Florida  
December, 2013 - present

**Marathon Woodhaven**

Woodhaven, Michigan  
October, 2014 - December, 2014

**GM Lansing Delta GK Underbody**

Delta Township, Michigan  
June 2014 - July, 2014

**Oakland University Elliott Tower**

Rochester, Michigan  
November, 2013 - December 2014

**Sunoco Inkster Terminal**

Taylor, Michigan  
September, 2014 - October, 2014

**Ford Allen Park Testing Facility**

Allen Park, Michigan  
April, 2014

**Sunoco Inkster Terminal**

Inkster, Michigan  
August, 2013 - October, 2013

**COBO Center Piling**

Detroit, Michigan  
August, 2014

**Ford Kentucky Truck Plant - Paint Shop**

Louisville, Kentucky  
March, 2014 - October, 2014

**GM Reduced Scale Wind Tunnel**

Warren, Michigan  
April, 2013 - July, 2013

**Shimizu G-TAC**

Canton, Michigan  
July, 2014 - September, 2014

**Neal Cavern at the Catlettsburg Refining Facility**

Neal, West Virginia  
February, 2014 - April, 2014

**Ford Dearborn Diversified Manufacturing**

Dearborn, Michigan  
May, 2013 - June, 2013

**Wayne State University Biomedical Bldg.**

Detroit, Michigan  
July, 2014 - August, 2014

**Benteler Steel / Tube**

Shreveport, Louisiana  
February, 2014 - December, 2014

**Ford DSP Rollform**

Dearborn, Michigan  
March, 2013 - July, 2013

**Palace Score Board**

Auburn Hills, Michigan  
July, 2014

**GM Lansing Grand River**

Lansing, Michigan  
February, 2014 - October, 2014

**The Rivers of Grosse Pointe**

Grosse Pointe Farms, Michigan  
March, 2013 - June, 2013

**Marathon Canton Refinery**

Canton, Ohio  
July, 2014

**Comerica Park Pepsi Porch**

Detroit, Michigan  
January, 2014 - February, 2014

**Ford DSP/DEFTP**

Dearborn, Michigan  
February, 2013 - March, 2013

**Ford Livonia Transmission**

Livonia, Michigan  
June, 2014 - September, 2014

**GM Flint Paint Shop**

Flint, Michigan  
February 2014 - November, 2014

**COBO Center**

Detroit, Michigan  
December, 2012 - May, 2013

## Industrial Surveying

**Ford Dearborn Stamping Plant**

Dearborn, Michigan  
October, 2012 - February, 2013

**COBO Hall**

Detroit, Michigan  
October, 2012 - September, 2014

**Chrysler SHAP Body Shop**

Sterling Heights, Michigan  
October, 2012 - February, 2013

**Sunoco Inkster Terminal**

Romulus, Michigan  
September, 2012 - November, 2012

**Ford Triple Cyclone Aluminum**

Dearborn, Michigan  
September, 2012

**St. Joseph Mercy Oakland**

Pontiac, Michigan  
August 2012 - February, 2013

**Sunoco Inkster Cavern  
Subsidence Monitoring**

Inkster, Michigan  
July, 2012 - August, 2012

**Neal Cavern at the Catlettsburg  
Refining Facility**

Neal, West Virginia  
June, 2012

**Marathon Canton Cavern**

Canton, Ohio  
June, 2012

**Marathon Woodhaven Cavern**

Woodhaven, Michigan  
June, 2012

**Chrysler SHAP Paint Shop  
Paint Line MW**

Sterling Heights, Michigan  
June, 2012 - December, 2012

**Chobani (Agro-Farma)**

New Berlin, New York  
May, 2012 - June, 2012

**GM Arlington Presses**

Arlington, Texas  
May, 2012 - May, 2013

**Chrysler SHAP Paint Shop**

Sterling Heights, Michigan  
May, 2012 - October, 2012

**Chrysler SHAP Paint Shop**

Sterling Heights, Michigan  
March, 2012 - September, 2012

**Ford Dearborn Stamping Plant and  
Crane Measurements**

Dearborn, Michigan  
February, 2012 - December, 2013

**COBO Center Phase 3**

Detroit, Michigan  
February, 2012 - December, 2012

**Ford Wayne Stamping Press Line #5  
Building Addition**

Wayne, Michigan  
January 2012 - February 2012

**GM Fort Wayne Assembly Plant**

Fort Wayne, Indiana  
October 2011 - November 2011

**COBO Center**

Detroit, Michigan  
September, 2011 - October, 2011

**Bell Building**

Detroit, Michigan  
August 2011 - September 2011

**GM Pontiac Press Upgrade**

Pontiac, Michigan  
August 2011 - December 2011

**Chrysler Trenton Engine Plant**

Trenton, Michigan  
July 2011 - August 2011

**Chrysler Sterling Heights Assembly  
Plant (SHAP) Paint Shop**

Sterling Heights, Michigan  
July 2011 - October 2011

**DTE Energy**

Monroe, Michigan  
March 2011 - December 2011

**DTE FERMI**

Monroe, Michigan  
May 2011 - August 2011

**COBO Center**

Detroit, Michigan  
April 2011 - May 2011

**General Motors New Topcoat Lines**

Lake Orion, Michigan  
April 2011 - July 2011

**Severstal NA Cold Rolling Mill**

Dearborn, Michigan  
March 2011 - December 2011

**Marathon Detroit Refinery DHOUP**

Detroit, Michigan  
March 2011 - December 2011

## Industrial Surveying

**Northrop Grumman Shipbuilding SMOF Building**

Newport News, Virginia  
February 2011 - October 2011

**COBO Center**

Detroit, Michigan  
January, 2011 - February, 2011

**Severstal Galvanizing Line**

Dearborn, Michigan  
July 2010 - January 2011

**GM Flint Stamping Press Upgrade**

Flint, Michigan  
November 2009 - August 2010

**Lockheed Martin Aeronautics**

Fort Worth, Texas  
October 2009 - December 2009

**Thyssen-Krupp New Steel Plant**

Calvert, Alabama  
September 2008 - July 2010

**Troy Beaumont Pedestrian Bridge**

Troy, Michigan  
August 2008 - January 2009

**National Alabama Railcar**

Cherokee, Alabama  
July 2008 - August 2008

**BMW Paint Shop**

Spartanburg, South Carolina  
April 2008 - July 2008

**BASF**

Wyandotte, Michigan  
February 2008 - May 2008

**Dearborn CSO Contract No. 8**

Dearborn, Michigan  
December 2007 - September 2011

**GETRAG Tequila Transmission Plant**

Tipton, Indiana  
August 2007 - November 2007

**Severstal Blast Furnace "C" Stoves**

Dearborn, Michigan  
July 2007 - February 2008

**Honda P2M-F Assembly Plant (Paint Shop)**

Greensburg, Indiana  
August 2006 - February 2007

**Honda P2M-F Assembly Plant**

Greensburg, Indiana  
August 2006 - February 2007

**Severstal Blast Furnace "B" Rebuild**

Dearborn, Michigan  
January 2008 - July 2008

**Honda Engine Plant 2PX**

Anna, Ohio  
August 2006 - February 2007

**DTE Energy**

Detroit, Michigan  
July 2006

**Severstal Blast Furnace "C" Rebuild**

Dearborn, Michigan  
March 2006 - October 2007

**COBO Hall Entrance**

Detroit, Michigan  
December, 2005

**GM Lansing ASRS Building**

Delta Township, Michigan  
October 2005 - May 2006

**Bodine Aluminum**

Jackson, Tennessee  
August 2005 - November 2005

**Wyandotte Power Plant Coal Volumes**

Wyandotte, Michigan  
2001 - Present

**Daimler Chrysler Dodge City**

Warren, Michigan  
October 1999

**Compuware**

Detroit, Michigan  
November, 1999 - February, 2004

**Chrysler Office Building**

Auburn Hills, Michigan  
December 1998