VECTOR STRUCTURAL ENGINEERING

A Solar Success Story

PRESS RELEASES-- *These annual press releases chronicle Vector's solar story. Since making the decision to enter the national solar market in 2015, the firm's solar engineering team has grown to exceed forty full and part-time engineers plus support staff. By Spring 2019, Vector had reviewed nearly 80,000 residential and commercial solar projects throughout the USA, and counting.*

- ✓ **2019 - Vector expands to Canada --** Vector Structural Engineering is now licensed in the Canadian provinces of Alberta, British Columbia and Ontario.
- ✓ **2018 – Vector prepares for solar power's coming growth --** After two years of spectacular growth in its Solar Engineering Services Division, Vector Engineers has emerged as a national leader in certifying residential solar power installations.
- ✓ **2017 – Vector Issues over 20,000 letters in 12 months --** By mid-2017, Vector's Solar team was routinely preparing over 2,000 certification letters per month.
- ✓ **2016 – Vector earns national market share in Solar Engineering Services** – Between Labor Day of 2015 and Memorial Day of 2016, Vector increased structural certification letters production by 700%. Based on national statistics, Vector had captured approximately 5% of the national market.
- ✓ **2015 – Vector addresses bottleneck in booming Solar Energy Industry** – Vector started preparing structural solar certification letters in 2010. In 2015, management hired James W. 'Jamey' Johnston and tasked him with growing the solar division.

VECTOR STRUCTURAL ENGINEERS – BACKGROUND – An introduction to Vector, including a summary of the company's professional structural engineering experience, as well as a description of our commitment to the success of our clients.

SAMPLE STRUCTURAL CERTIFICATION LETTER – Vector is fluent with the requirements of jurisdictions throughout America. A sample letter is attached. The calculation pages are proprietary and are therefore not included in this sample packet. Naturally, Vector includes calculation pages whenever jurisdictions require them.

Vector Structural Engineering Now Licensed in Canada

Rapidly growing firm's engineering expertise will help Canadian clients meet construction, budgetary, and licensing goals.

(Draper, UT) January 10, 2019—Vector Structural Engineering, which is licensed in all 50 U.S. states, the District of Columbia, and Puerto Rico, is now also licensed in the Canadian provinces of British Columbia, Alberta, and Ontario.

"It's a natural extension for us," says Vector Principal Engineer Roger Alworth. "Many of our clients work in regional or national markets and they've long valued our ability to save them money and time, no matter where a project might be located. We've had numerous queries from Canadian and cross-border firms looking for expertise in our areas of specialization, and we're delighted now to be in a position to help them."

Vector Structural Engineering, headquartered in Draper, Utah, about 20 miles from Salt Lake City, is one of the fastest-growing firms in its field. The company's team of experienced engineers and CAD professionals is broken into groups that specialize in high-end custom homes, small and medium-sized commercial buildings, industrial structures, multi-family buildings and parking structures, specialty structures (bridges, towers, enclosures, retaining walls, etc.) and residential and commercial solar installations.

Key components of Vector's service include:

- *Detailed structural drawings.* The company's goal is to avoid creating a painful "IQ test" for the contractor, and to solve construction challenges before actual construction begins.
- *Value engineering.* Typically, the initial layout of each project is reviewed in-house for value engineering opportunities—ideas about minor revisions that could create significant construction cost savings.
- *Life-of-the-project service.* Company policy is to provide prompt response to clients' concerns and questions—usually at no additional cost—through the life of the project.
- *Inclusive bidding.* Vector's experience, efficiency, and relatively low overhead allows it to keep its fees very competitive.

"The focus of our business, simply put," says Alworth, "is making our clients successful at what they do. Almost all our work comes from repeat clients; builders and contractors who have worked with us before routinely demand that developers or architects use Vector Structural Engineering. We feel confident this will be the case as we expand our activities in Canada, and we look forward to expanding our work with the building and contracting community north of the border."

About Vector Structural Engineering:
Founded in 2002, Vector Structural Engineering is a full-service structural engineering firm with over 2,500 clients throughout the United States. The company's areas of expertise include multi-family, residential, commercial, telecom, bridges, industrial, and solar. Services include the design of new structures, the analysis and redesign of retrofit and repairs of existing structures, as well as residential and commercial solar structural certifications. Expert witness experience includes structural defects, foundation settlement, building code analysis, and soil and structure stabilization. Vector's team includes engineers, a full drafting division, and support staff. The company is headquartered in Draper, Utah, with satellite offices in Mesa, Arizona; Layton, Utah; St. George, Utah; and Tustin, California.

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Vector Prepares for Solar Power's Coming Growth

Utah-based structural engineering firm expands headquarters and ramps up staff to serve solar industry's coming period of mature growth.

(Draper, UT) March 15, 2018—After two years of spectacular growth in its Solar Engineering Services Division, Vector Engineers has emerged as a leader in certifying residential solar power installations. "One of our divisions," says Vector Principal Engineer Roger Alworth, "performs Structural Solar Engineering Services. "In 2015, we prepared just over four thousand certification letters; in 2017, that number jumped to over twenty-three thousand."

Vector's success in the national Telecom sector, notes Alworth, helped Vector be prepared to meet the solar community's needs. The company spent five years becoming familiar with requirements of both residential and commercial solar installers. By that point, Vector was licensed in every state, and had built the software necessary to track and assign jobs in a high-volume, rapid-throughput environment. "The proprietary systems we developed over the past fifteen years," says Alworth, "have enabled us to meet our clients' time constraints."

To accommodate its rapidly expanding customer base, less than a year ago the company completed construction of a new, expanded headquarters facility in Draper, Utah. "We allotted significant space for our 'solar cell,'" says Alworth, "and we are rapidly filling it up. Over the past two years, we have hired 32 new fulltime and part-time engineers to support our solar practice—and the next major phase of solar growth hasn't even started yet."

Industry experts agree. Solar project developer Sol Systems projects that over the next year, the solar industry will develop, construct, and finance $25 to $30 billion in solar assets, build 20% to 25% of the country's new electrical capacity, and continue to employ hundreds of thousands of people. It is widely predicted that by 2020, solar will be the dominant source of new electricity generation in the United States.1

This next phase of solar development, says Alworth, will come as a result of the experience gained by a young but rapidly maturing industry and the resulting streamlining of industry processes. His own company, in fact, has played a significant role in the streamlining of one essential industry process, the issuance of residential structural solar certification letters.

Before a household solar system can be installed, the designer and installer must submit engineering drawings and a building permit application letter to the building department. In many cases, a structural engineering firm licensed in the state where the system is to be installed must first must provide a structural solar certification letter. Vector, which is licensed

in all 50 states, Washington, D.C. and Puerto Rico, is able to help its clients stay on schedule by executing these certification letters quickly, often in 1 to 2 business days.

"As we do that," says Alworth, "we adhere to the same high engineering standards we apply to everything we do. We are proud to be part of the American solar sector's explosive growth—and proud to be ready to continue to meet the industry's needs in the years ahead."

About Vector Engineers:

Founded in 2002, Vector Engineers is a full-service structural engineering firm with over 2,500 clients throughout the United States. The company's areas of expertise include multi-family, residential, commercial, telecom, bridges, industrial, and solar. Services include the design of new structures, the analysis and redesign of retrofit and repairs of existing structures, as well as residential and commercial solar structural certifications. Expert witness experience includes structural defects, foundation settlement, building code analysis, and soil and structure stabilization. Vector's team includes thirty engineers, a full drafting division, and support staff. The company is headquartered in Draper, Utah, with satellite offices in Mesa, Arizona, Layton, Utah, St. George, Utah, and Tustin, California.

1. Horwitz, Yuri, "Why Solar Is on a Path to Dominance," Green Tech Media, February 15, 2018.

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FOR IMMEDIATE RELEASE

Vector Structural Engineering Becomes Solar Industry Leader after Issuing over 20,000 Structural Certification Letters to Solar Installers in the Past 12 Months

With licensed professionals covering all 50 states, Puerto Rico and the District of Columbia, Vector helps the solar industry continue its ongoing expansion as hundreds of installers nationwide utilize Vector's rapid SOLARCert™ system to produce Solar Certification Letters in as little as 24 hours for less than $200 each.

DRAPER, Utah — JULY 11, 2017 — Since July 2016, Vector Structural Engineering has issued over 20,000 Structural Certification Letters to solar installers, becoming a solar industry leader virtually overnight.

With over 60 professionals on staff and offices in three states, 15-year-old Vector Structural Engineering is an emerging player across the structural engineering field. According to Vector Founder and Principal, Roger T. Alworth, P.E., it was a strict adherence to process-based systems and excellent customer service that allowed the company to jump to over 1,500 Structural Certification Letters per month in less than one year.

"As it turns out, the vast majority of municipalities in the United States require some form of certification before allowing a residential solar system installation," Alworth said. "Expanding our solar division was a matter of being at the right place at the right time with the right experience."

By 2015, Vector's Telecommunications Division already had a decade of national experience delivering rapid turn-around on small and medium-sized projects. Vector's management team recognized that solar installers needed the same kind service — fast, national and cost-competitive. "We hired industry veteran James W. 'Jamey' Johnston as business development lead for Vector SE's solar division, and his contribution has been critical to the division's success," Alworth added.

SOLARCert™ is a rigorous, process-based system crafted especially for Solar Installers. These professionals need an independent third-party to analyze and certify the structural soundness of individual homes throughout America, typically in 24 hours or less and at a cost of under $200 per Structural Certification Letter.

"Having licensed professional engineers in every state, Puerto Rico and the District of Columbia means Vector SE can deliver certifications throughout the U.S.," Johnston said. "SOLARCert is what leading solar installers are asking for. They deal with one company that has national coverage. They have a single, personal point of contact. The formula is working. We've averaged over 1,500 letters per month during the first half of 2017. In fact, we are producing hundreds of Solar Certification Letters each month for several individual solar companies."

— more —

According to the Solar Energy Industries Association, there are currently over 1 million buildings in the U.S. with rooftop solar systems.

“Our best estimate suggests that there were over 500,000 new solar systems installed on residential rooftops in 2016,” Johnston said. “And although 20,000 is only four percent of the overall marketplace, we believe it makes us one of the largest providers of Solar Certification Letters in the country.”

Solar companies and installers looking for a fast, professional and effective alternative for Structural Certification Letters should contact Johnston at james@vectorse.com or 800-558-0013.

About Vector Structural Engineering:
Formed in 2002, Vector Structural Engineers is an emerging structural engineering firm, with five offices in the three states (Utah, California and Arizona) and over 60 professionals on staff. Vector SE specializes in fast, professional and accurate structural design services in six main industries — Solar, Telecommunication, Residential, Commercial, Bridges, and Industrial. With team members licensed in all 50 states, Puerto Rico, and the District of Columbia, Vector SE is an ideal partner for architects, developers, builders, government agencies, and other service providers.

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MAY
2016

FOR IMMEDIATE RELEASE

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Vector Solar Earns National Market Share in Solar Engineering Services

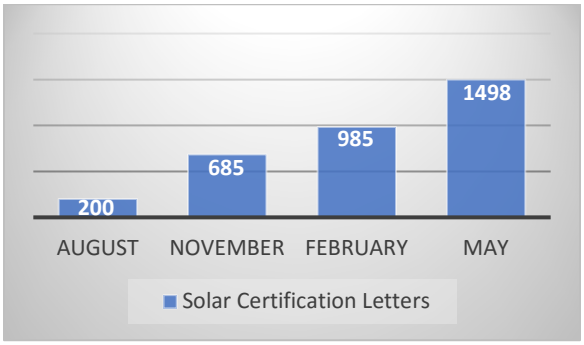
In Fall of 2015, Vector Engineers announced that they were addressing a "bottleneck in the solar energy industry."

Viewed from the perspective of six months performance, growing more than 700% between Labor Day 2015 and Memorial Day 2016, and earning glowing customer testimonials along the way, it appears they knew what they were talking about. Vector Solar has worked itself into a position of national solar structural engineering leadership.

In late summer of 2015, Vector Solar was preparing a respectable 200 structural certification letters each month for some twenty installers. Recognizing that the solar market was growing rapidly, Roger Alworth, Vector's Principal Engineer, and Joe Sharp, the company's Senior Project Manager, selected renewable energy industry veteran James W. 'Jamey' Johnston to grow the division - and he did.

By November of 2015, Vector Solar increased production by more than threefold, preparing nearly 700 residential and commercial letters. In May of 2016, the engineers at Vector Solar prepared nearly 1,500 letters for over 100 of America's leading solar installers. That's over 700% growth in less than a year.

Based on available national statistics, Vector Solar's May preparation of nearly 1,500 structural certification letters gives Vector Solar between 5% and 10% of America's certification letter market. That's leadership.



Stress Tested Performance: Customers continue to praise Vector Solar. Despite its rapid growth, the company continues to meet its promise of a "single business day turn-around" for residential certification letters.

According to Chris Hall, President and Founder of New York's Apex Solar, *"Vector is an amazing company to do business with ... I will continue to introduce our national partners to Vector Solar ... they need your [Vector's] engineering services."*

Summary

Nationally Licensed: Vector is licensed in all 50 states, Washington, D.C., and Puerto Rico.

One Day Turn-Around: Residential letters are turned around within a single business day.

Cost Competitive: $150 (or less, depending on monthly volume) for residential, sloped-roof flush mount certification letters.

Proven, Proprietary, Scalable: Founded in 2002, Vector has developed its own systems, enabling the firm to accommodate the requirements of fast-growing, demanding markets, including solar and telecommunications.

NOVEMBER 2015 **FOR IMMEDIATE RELEASE**

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Vector Engineers Addresses "Bottleneck" in Booming Solar Energy Industry

The Vector Engineers Solar Service Division, through proprietary processes for preparing Residential Certification Letters, eases a persistent source of delays in the residential solar sales and installation cycle.

(Sandy, UT) November 10, 2015—According to a recent report from the Solar Energy Industry Association (SEIA), during the second quarter of 2015, residential solar installations in the U.S. grew 70% above the same quarter in 2014. With over 135,000 installations in the first half of 2015, nearly 784,000 U.S. homes and businesses have gone solar.[1] "This growth rate is expected to continue for the foreseeable future," notes Roger Alworth, Principal Engineer at Vector Engineers, a leading full-service structural engineering company. He goes on to say, "The 2015 report from the Energy Information Administration projects renewable energy production to grow faster than any other power source through 2040."[2]

The solar business is maturing and evolving from an enthusiastic- and craft-driven activity to a competitive, well-run, sophisticated industry. "There are companies installing hundreds, if not thousands of systems every month," says Alworth. "Every step in the process is being scrutinized for areas where time and cost can be reduced."

A chronic source of delay in the process—and thus additional cost—has to do with documentation required for building permits. Once a contract for a solar system has been signed, a detailed site survey is made to determine exactly where and how the system will be installed on the home and connected to the grid. When the survey is completed, engineering drawings are created; the next step is to submit the drawings and a building permit application letter to the local housing authority.

Before that can happen, however, a structural engineering firm licensed in the state where the system is to be installed is often required to review the engineering drawings and issue a Residential Solar Certification Letter. This letter, which is required in most building jurisdictions in the United States, must be submitted to the "Authority Having Jurisdiction" or "AHJ" (often the building inspection department) along with the building permit application and the plans. "The certification letter," says Alworth, "can be a significant bottleneck. There are companies that have had to wait a week or two—or even three—to get their letter prepared. Meanwhile, equipment and manpower are tied up, and the project is frozen in place."

Alworth and his colleagues regard this as completely unnecessary. Vector Engineers—with employees licensed in all 50 states, as well as Puerto Rico and the District of Columbia— has developed internal processes that enable the company to deliver rapid turnaround on Residential Solar Certification Letters. Clients can submit materials by FTP, Dropbox, or email, and receive most letters back in a single business day—at a price significantly lower than the industry average.

"Residential and commercial solar is going to play an important role in this country's future," says Alworth. "We are committed to this industry, and we are devoted to helping our clients succeed."

About Vector Structural Engineering:

Founded in 2002, Vector Structural Engineering, LLC is a full-service structural engineering firm with over 2,000 clients throughout the United States. The company's areas of expertise include multi-family, residential, commercial, telecom, bridges, industrial, and solar. Services include the design of new structures, the analysis and redesign of retrofit and repairs to existing structures, as well as residential and commercial solar structural certifications. Expert witness experience includes structural defects, foundation settlement, building code analysis, and soil and structure stabilization. Vector's team includes thirty engineers, a full drafting division, and support staff. The company is headquartered in Sandy, Utah, with satellite offices in Layton, Utah, St. George, Utah, Gilbert, Arizona, and Tustin, California.

1. "U.S. PV Market Surpasses 20 GW Milestone, On Pace to Grow 24% Over 2014," Solar Energy Industry Association U.S. Solar Market Insight, updated September 9, 2015.
http://www.seia.org/research-resources/us-solar-market-insight

2. "Annual Energy Outlook 2015," U.S. Energy Information Administration, April 2015.
http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf

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Background

Summer 2017

Introduction

Founded in 2002, Vector Structural Engineering has a staff of over 60 in five offices in Utah, California and Arizona. Our engineering team includes licensed civil engineers, seven of whom are also licensed structural engineers. The Vector engineering team has over 150 years of combined engineering design experience, supported by complete in-house Computer Aided Design & Drafting and administrative departments. Our engineers are licensed in all 50 states, the District of Columbia, and Puerto Rico. With nationwide licensure as well as diverse experience and expertise, Vector Structural Engineering is uniquely positioned to provide engineering services for clients with regional and national engineering needs.

Vector's success is built on a foundation of technical expertise and outstanding client service. We place great emphasis on providing sensible and technically sound engineering solutions. Striving to do everything we can to make each project successful, Vector's corporate culture revolves around a sense of urgency and sensitivity to our clients' project schedules and budgets. The majority of our business comes from clients that have been with Vector for many years.

Experience

Vector has developed expertise in the analysis and design of many different types of structures including: telecommunications structures and concealments, commercial and residential solar, government facilities, educational facilities, commercial and retail buildings, multi-family residential buildings, industrial facilities, retaining and drainage structures, free standing signs, and pedestrian bridges. Past project experience includes the design of thousands of telecommunication structures all over the country. Principal engineer, Roger Alworth, has been designing these types of structures for over 20 years.

Vector's experience includes the design of structures constructed of concrete, masonry, steel, timber, fiberglass reinforced polymers (FRP), and aluminum. Our design experience includes multi-story buildings, elevated post-tensioned concrete structures, specially reinforced concrete and masonry structures, free-standing and guyed towers, retaining structures utilizing soil-nails and micro-piles, foundations utilizing helical piers, drilled caissons and rock anchors, and steel structures utilizing buckling restrained braced frames (BRBF), special moment resisting frames (SMRF), special concentric braced frames (SCBF). Our staff incudes experts in the design of structures in regions of high winds, high seismic loads, high snow loads, extreme cold, as well as industry-specific specialty loads. We have engineers who are members of engineering organizations including ASCE, ACI, AISC and TIA-EIA.

Engineers at Vector have been retained on multiple occasions to provide expert witness services for the Utah Attorney General's Office as well as for private disputes related to structural engineering issues. In addition, our firm has performed the analysis on hundreds of existing structures to determine their ability to resist current code prescribed loads as well as proposed additional loads.

Coupled with an extensive structural engineering background, Vector also employs engineers with civil engineering experience. Engineers at Vector have designed site plans, grading plans, utility plans and roadway plan and profiles for commercial projects, residential communities, and multi-family projects. In addition, our engineers have performed drainage studies, master site planning, and engineered drainage structures, detention basins, storage tanks, and storm water pollution prevention plans. Our engineers have designed hundreds of retaining wall projects constructed of masonry, concrete, pre-cast blocks and boulders.

Engineers at Vector are proficient with commercially available analysis and design software packages such as RISA3d, RISA Foundation, RISA Connection, L-Pile, RetainPro, and TowerNx. Our CADD draftsmen are experts in preliminary framing layouts and utilize the most current editions of AutoCAD and Revit Structure. In addition, our engineers undergo regular in-house and outside training to establish and maintain expertise in various engineering fields.

Service

Vector is a service-driven company. We keep our clients informed and we respond quickly to phone calls, RFI's, plan check comments, and submittals—maintaining a sense of urgency throughout each project. In addition, our experienced engineers are available to meet with clients in our office or on site. We take project schedules seriously and work with clients to make sure our timeline works within their project schedule. In addition, we understand that quick attention to service during construction is essential to keeping the overall project on schedule.

Engineers at Vector are trained to handle multiple projects at the same time while keeping priorities and schedules intact. This has allowed our experienced, service driven team to complete over 2,000 projects every year since 2013. Perhaps the most telling statistic related to our high level of service is the fact that over 90% of our business is generated from current satisfied clients and direct referrals.

Vector Engineers organizational structure is uniquely designed to effectively manage numerous small and medium sized projects. Projects are rapidly assigned to a project engineer who has the individual responsibility to ensure the project is completed accurately and on time. Every project is additionally assigned a supervising engineer who can assist in tracking progress, answer technical questions and communicate with the client. Every completed project is thoroughly back checked prior to shipping or emailing stamped drawings and calculations. The ability to effectively manage thousands of projects is enhanced by using a custom in-house developed intranet software program which tracks assignments, project progress, due dates, revisions to scope, budgets and allows real-time communication and notification. Vector Engineers has years of experience in completing thousands of projects for hundreds of clients on time and accurately.

Quality

Projects undergo a value engineering process after a preliminary review has been performed. Typically, this process allows the design team to consider subtle to significant changes that may save considerable construction costs. Prepared with the goal of solving challenges before construction begins, our construction documents are not cluttered or confusing but rather provide clear, accurate detailing and references. They are designed to be enabling and field-ready, not a painful IQ test for the contractor.

VSE Project Number:

April 12, 2017

Company Name
ATTENTION:
Address
City, State Zip

REFERENCE: Job Name: Location designators (address, city, state, zip etc.) Solar Array Installation

To Whom It May Concern:

We have reviewed the documents and photographs provided by COMPANY NAME relating to the installation of the solar array at the above-referenced site. Based upon our review, it is our conclusion that the installation of the solar array on this existing roof will not adversly affect this structure. It is our understanding that the structural components of the existing roof framing are in good condition and free of damage. The design of the solar panel racking (mounts, rails, etc.) and connections to the roof is by the manufacturer or contractor. Please note a representative of Vector Structural Engineering has not physically observed the roof framing.

Design Parameters

Code: International Building Code, 2012 Edition
Risk Category: II
Design wind speed: 115 mph (3-sec gust) per ASCE 7-10
Wind exposure category: C
Ground snow load: 30 psf

Existing Roof Structure

Roof structure: 2x4 manufactured trusses @ 24" O.C. (timber grade: SPF#2)
Roofing material: composite shingles
Roof pitch: 8:12

Conclusions

Our conclusion regarding the adequacy of the existing roof is based on the fact that the additional weight of the solar array is 3 psf or less. In the area of the solar array, other live loads will not be present or will be greatly reduced. Regarding snow loads, because the panels are slippery and unobstructed, effective snow loads will be reduced in the area of the solar array. The member forces in the area of the solar panels are not increased by more than 5%; thus, the stresses of the structural elements are not increased by more than 5%. Therefore, the requirements of Section 3403.3 of the 2012 IBC are met and the structure is permitted to remain unaltered.

The solar array will be flush-mounted (no more than 6" above the roof surface) and parallel to the roof surface. Thus, we conclude that any additional wind loading on the structure related to the addition of the proposed solar array is negligible. The connections to the existing roof shall be spaced at 48" maximum. Regarding seismic loads, we conclude that any additional forces will be small. With an assumed roof dead load of 13 psf, solar array dead load of 3 psf, and affected roof area of 33% (maximum), the additional dead load (and consequential seismic load) will be 9.3% .This calculation conservatively neglects wall weight. Because lateral loads are increasing by less than 10%, the installation of the solar panels meets the requirements in Section 3403.4 of the 2012 IBC and the structure is permitted to remain unaltered.

Limitations

Installation of the solar panels must be performed in accordance with manufacturer recomendations. All work performed must be in accordance with accepted industry-wide methods and applicable safety standards. The contractor shall notify Vector Structural Engineering, LLC should any damage, deterioration or discrepancies between the as-built condition of the structure and the condition described in this letter be found. Particular attention must be paid to the maximum allowable spacing of connections and the location of solar panels relative to roof edges. Connections to existing roof framing must be staggered so as not to overload any existing structural member, except at array ends. The use of solar panel support span tables provided by others is allowed only where the building type, site conditions, site-specific design parameters, and solar panel configuration match the description of the span tables. Electrical engineering is the responsibility of others. Waterproofing around the roof penetrations is the responsibility of others. Vector Structural Engineering assumes no responsibility for improper installation of the solar array.

VECTOR STRUCTURAL ENGINEERING, LLC

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Roger Alworth, P.E.
CO License: Principal

Enclosures

RTA/dgd