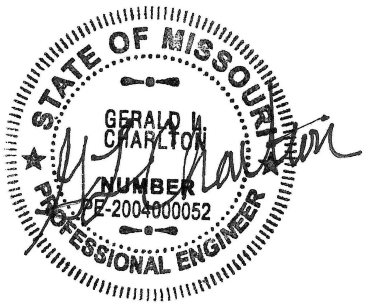
Structural Assessment Associated with Future Solar Array Installation

For

Lee's Summit Honda
401 NE Colbern Rd.
Lee's Summit, MO

Prepared by

C1 energy solutions, llc



December 10, 2020

9913 Sunset Drive ♦ Lenexa, Kansas 66220 ♦ Phone: (913) 707-4325

C1 energy solutions, llc

December 10, 2020

Artisun Solar
Attn: Mr. Jason Mendenhall
12916 5th Street
Grandview, MO 64030

RE: Structural Report – Solar Array Installation
Lee's Summit Honda

Dear Mr. Mendenhall,

At your request, we have performed a structural inspection of the roof framing system at the above referenced facility. Our inspection of the facility, focused on the proposed plan to install a ballasted solar array on buildings flat roof. This letter addresses our review of the proposed, ballasted solar system, along with our assessment on the impact this system has on the existing structure.

Impact to Existing Structural Elements Carrying Gravity Loads

The gravity load of the proposed ballasted solar array is approximately 6.0 psf. This gravity load takes into consideration the uniform placement of 2 – 32 lb masonry blocks per each PV panel placed.

The secondary framing members consist of steel 32LH06 steel joists.

The 32LH06 joists are spaced a 5'-0" on center and span 52 feet. The controlling Load Combination, based on ASCE 7-10, is the following:

Chapter 2, Section 2-4 Combining Loads Using Allowable Stress Design

Load Combination (6a) DL + 0.75(0.6W) + 0.75(Lr or S); (see attached calculations)

432LH06, 52ft Span, 5'-0" Tributary Spacing; 304 plf allowable capacity (Vulcraft Joist Catalog)

Using the above controlling Load Combination, the actual stresses (taking into account, the DL of the solar addition) do not exceed the allowable stresses. Therefore, the existing structural elements carrying gravity loads have sufficient capacity to allow for this solar array installation.

Impact to Existing Structural Elements Carrying Lateral Loads (Gravity Load & Seismic Load)

The Dead Load from the solar array is approximately a 14.4% increase when examining the controlling Load Combination with a uniform 4.5 psf solar array weight (see attached calculations). However, the solar array covers approximately 67% of the roof footprint. This equates to 3.1 psf, which is approximately 10% of controlling Load Combination 6a [DL + 0.75(0.6*W) + 0.75(S or Lr)]. Therefore, the approximate 10% increase in the Lateral Loads (Gravity & Seismic) satisfies IBC Section 3403.4 Existing Structural Elements Carrying Lateral Loads.

Impact to Existing Structural Elements Carrying Lateral Loads (Wind Load)

The proposed roof attached solar array presents an increased profile for lateral wind loads. The attached solar panels extend approximately 2 feet above the roof surface. The existing eave height of the building is 28'-0". Therefore the vertical profile of the building is increased by approximately (28+2)/28 = 1.0714 or an increase in profile of 7.14%. The less than 10% increase in the Lateral Loads (Wind) satisfies IBC Section 3404.4 Existing Structural Elements Carrying Lateral Loads.

Our assessment of the steel joist/deck metal roof structure, at the above referenced address, has sufficient structural capacity in the gravity load and lateral load resisting system to support the proposed roof ballasted solar array.

Please call if you have any questions or require further information regarding this assessment.

Best regards,

Gerald L. Charlton, P.E.

Honda

Structural Assessment - Existing Roof Structure

Examine Existing 32LH06 Spa. 5'-0" o.c.
Safe Load in Pounds = 16,700 Span = 52' (Shear)

Corresponding Linear Loading = $\frac{16,700}{52/2}$ = 642 plf

or Verify Max Load for Bending

@ 52' $\frac{\text{Allowable}}{\text{Avail } 24/360} \Rightarrow \frac{304 \text{ (plf)}}{179 \text{ (plf)}}$

309 ÷ 5' = 61.8 psf

Actual Loading w/ Solar Alterations:

DL: 3psf Roofing/Deck
3psf Self Wt.
3psf MEP
9psf × 5 ⇒ 45 plf

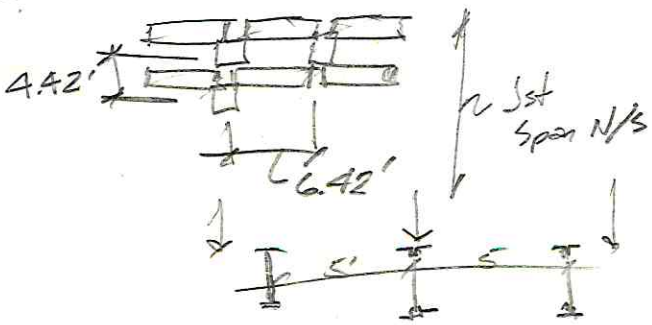
Lr: 20psf × 5 ⇒ 100 plf

Snow: $P_{min} = P_g \cdot I$ where I = 1.0, P_g = 20psf

$P_{min} = 20 \cdot 1.0 \cdot 5 \Rightarrow$ 100 plf

Wind: +/- 16psf C&C
16 × 5 ⇒ 80 plf

Solar:



Ps Solar · 50A = 200#
Panels: 20
Ballast 2@32 64
134

134 ÷ 4.42 = 30 psf
30/5 = 6 psf

Honda

Structural Assessment - Existing Roof Structure

(Continue) Examine 32LH#6

Load Comb. (3) DL + (S or Lr)

45 + 100 + 30 = 175 psf < 309 psf Allowable

DL + S(solar)

Load Comb. (62) DL + .75(.6W) + .75(S or Lr) Okay

45 + .75(.6×80) + .75(100) + 30 = 156 psf < 309 Allowable

Okay

The above assessment examines the ballasted array assuming

2 block (ballast) uniformly spaced

Actual footprint is comprised of 1 block uniformly spaced

Actual Solar 4.5 psf w/ footprint covers approx 67% of roof

4.5 × .67 = 3.1 psf

Load Comb. (6a)

9 + .75(.6×16) + .75(20) = 31.2

31.2 × .1 = 3.1 psf

Okay for Lateral

$100 \times \frac{4.5}{31.2} = 14.4\%$

> 10%

allowable 10% increase for lateral loads w/ alterations