ENTRY FORM

DVASE
2021 Excellence in Structural Engineering Awards Program

PROJECT CATEGORY (check one):

Buildings under $5M		Buildings Over $100M	
Buildings $5M-$15M		Other Structures Under $1M	
Buildings $15M - $40M		Other Structures Over $1M	X
Buildings $40M - $100M		Single Family Home	

Approximate construction cost of facility submitted:	$6 million
Name of Project:	HighFlyer Zipline
Location of Project:	Foxwoods Resort Casino, Mashantucket, CT
Date construction was completed (M/Y):	4/2018
Structural Design Firm:	The Harman Group, Inc.
Affiliation:	**All entries must be submitted by DVASE member firms or members.**
Architects:	N/A
General Contractor:	Mattern Construction, Inc

Company Logo (insert .jpg in box below)

Important Notes:

Please .pdf your completed entry form and email to bsagusti@barrhorstman.com.

Please also email separately 2-3 of the best .jpg images of your project, for the slide presentation at the May dinner and for the DVASE website. Include a brief (approx. 4 sentences) summary of the project for the DVASE Awards Presentation with this separate email.

Provide a concise project description in the following box (one page maximum). Include the significant aspects of the project and their relationship to the judging criteria.

HighFlyer Zipline, a 3,750 foot-long zipline thrill ride, begins on the rooftop of the 330-foot-tall Fox Tower at Foxwoods Resort Casino in Mashantucket, Connecticut. Thrill seekers can experience speeds approaching 60 miles per hour as they fly over the trees surrounding the resort, landing at the Mashantucket Pequot Museum & Research Center.

The Highflyer Zipline is the only zipline in North America that lets you fly from the top of a 30-story hotel tower. The Harman Group designed the original structure of the Fox Tower in 2006, so designing the zipline support structure was a natural fit. The design process required an evaluation of the zipline forces provided by the zipline specialty engineer (Yang Engineering Solutions) on the existing tower structure. The Harman Group designed the connection of the zipline system to the shear wall core of the tower, the connection of the takeoff platform to the Tower, as well as the foundations at the landing site. The foundation is a combination of reinforced spread footings and a mat foundation with rock anchors.

Zipline Effect on the Tower
The existing Tower lateral model was utilized to calculate the global increase in member stresses resulting from the zipline. The columns supporting the takeoff platform were able to be justified by the allowable stress increase permitted under IEBC. The tower shear walls required re-analysis to confirm that the loads of the zipline did not exceed their capacity. The zipline loads caused an increase in building drift of about 1-1/2".

Zipline Support at Tower Core
Ziplines were anchored to the Tower core shear walls with a structural steel transfer truss and post installed adhesive anchors. A structural steel transfer truss was employed to distribute the zipline loads to the tower core shear walls. The ziplines met the tower core inside of the existing mechanical penthouse where access was difficult, being on the 30th floor of the Tower. The transfer truss was designed to the weight and size of each piece, since each piece of steel had to be brought to the 29th floor through the freight elevator. The pieces were then carried to the penthouse by hand or by using chain hoists up four flights of stairs where the truss would be assembled and attached to the core shear walls.

The transfer truss and ziplines conflicted with an existing egress stair in the penthouse. THG designed a replacement stair that was carefully configured to clear the truss, zipline cables and existing mechanical equipment, all while maintaining stair code dimensional requirements.

The ziplines penetrated the penthouse building envelope, including some horizontal façade support girts. THG designed modifications to both the girts and the connections of the existing curtainwall back to the building structure to accommodate the zipline penetrations.

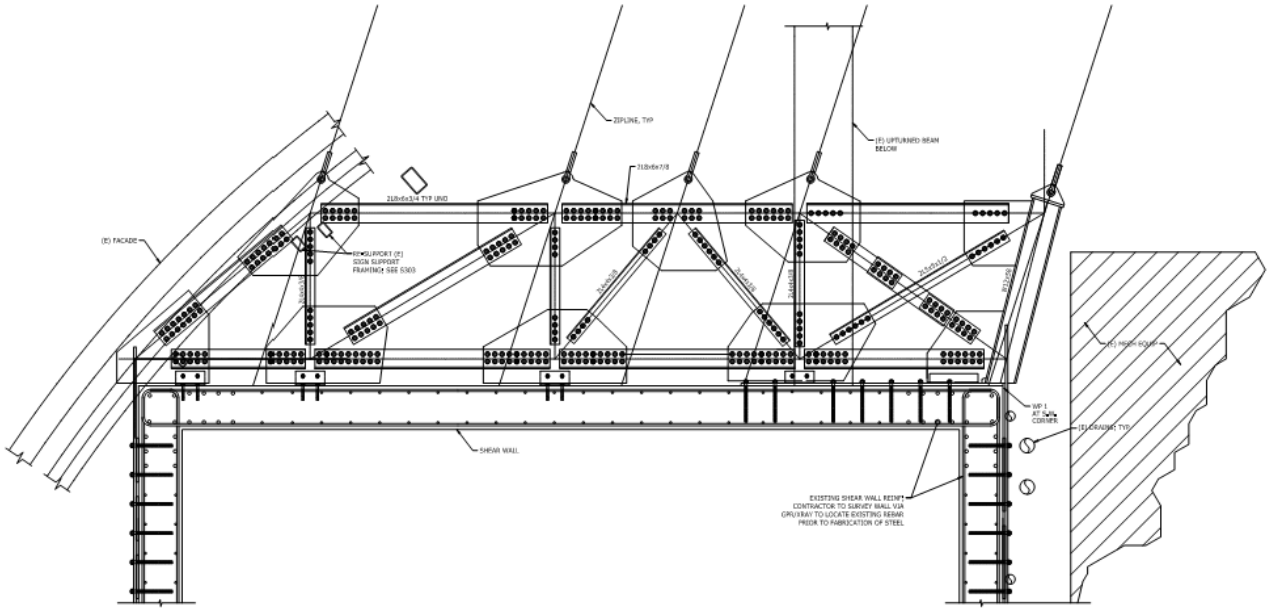
Zipline Support at Tower Take off Platform
Beyond their anchorage to the transfer truss, the ziplines traversed through the penthouse space and left the building envelope, soon crossing over and bearing on the takeoff platform space truss. The takeoff platform superstructure was designed by the Zipline specialty engineer, Yang Engineering Solutions. The takeoff structure bears directly above existing building column and shear walls. Since the roof structure is a post-tensioned slab, the anchorage details of the takeoff structure columns required flexibility to account for the presence of PT tendons in the roof slab. The contractor was required to scan the roof slab and locate tendons prior to installing the column bases.

Zipline Support at Landing Zone
From the takeoff platform the ziplines soar 3,750 feet over the Foxwoods complex and through the forest of the Mashantucket Pequot Reservation. The ziplines anchor to the specialty engineer's landing zone structure, which is supported by a mat foundation with rock anchors.

Go for a ride: https://youtu.be/W0X9OgPn99Y?t=878

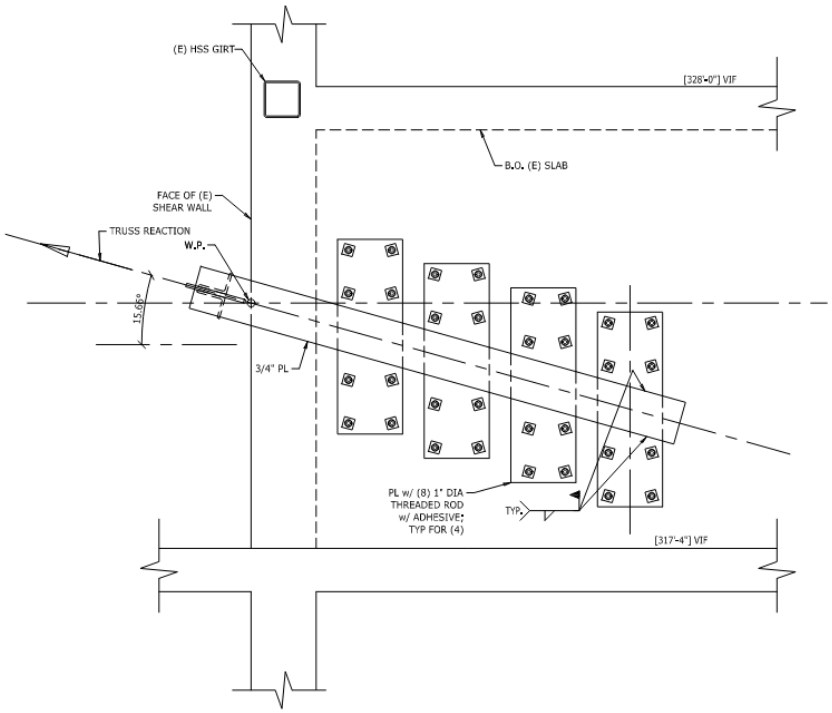
The following 5 pages (maximum) can be used to portray your project to the awards committee through photos, renderings, sketches, plans, etc…

Zipline anchorage transfer truss within Fox Tower penthouse

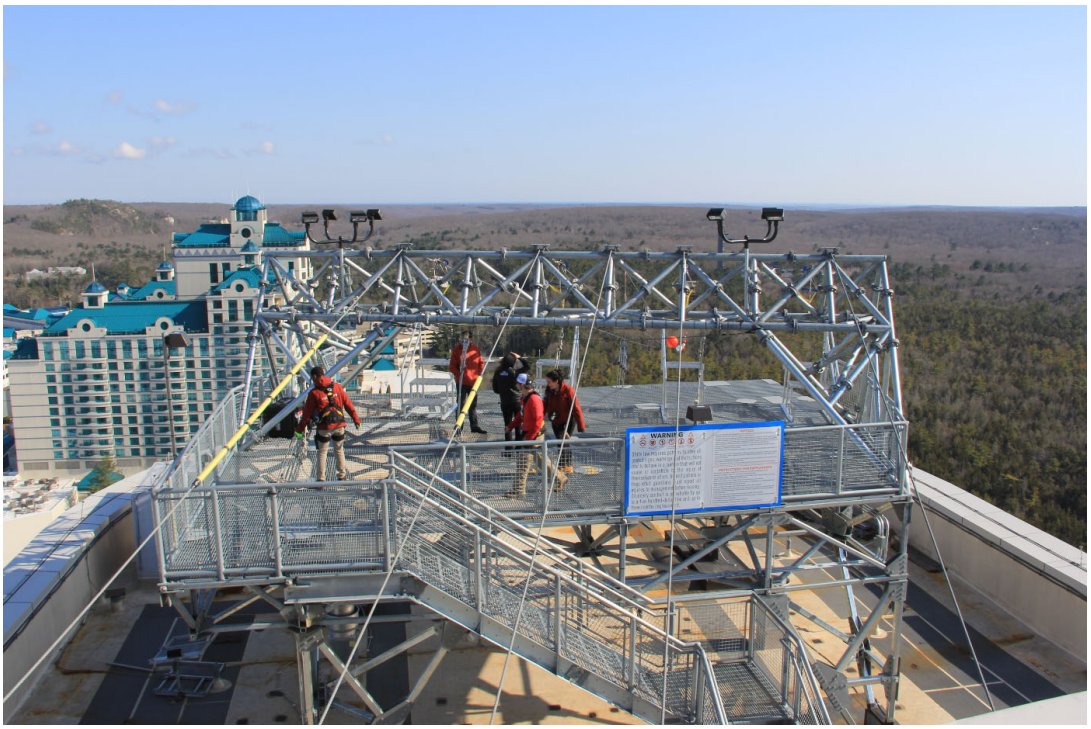


Zipline anchorage transfer truss within Fox Tower penthouse, showing tight clearances to existing façade and mechanical equipment

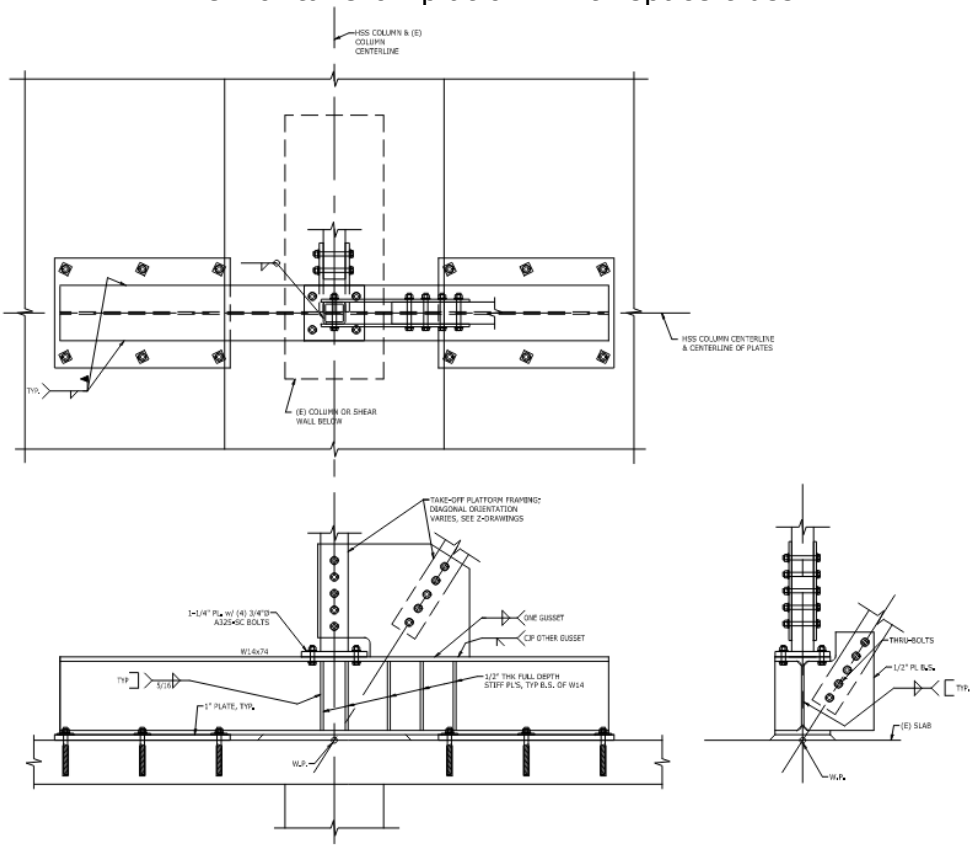
View of zipline transfer truss within mechanical penthouse



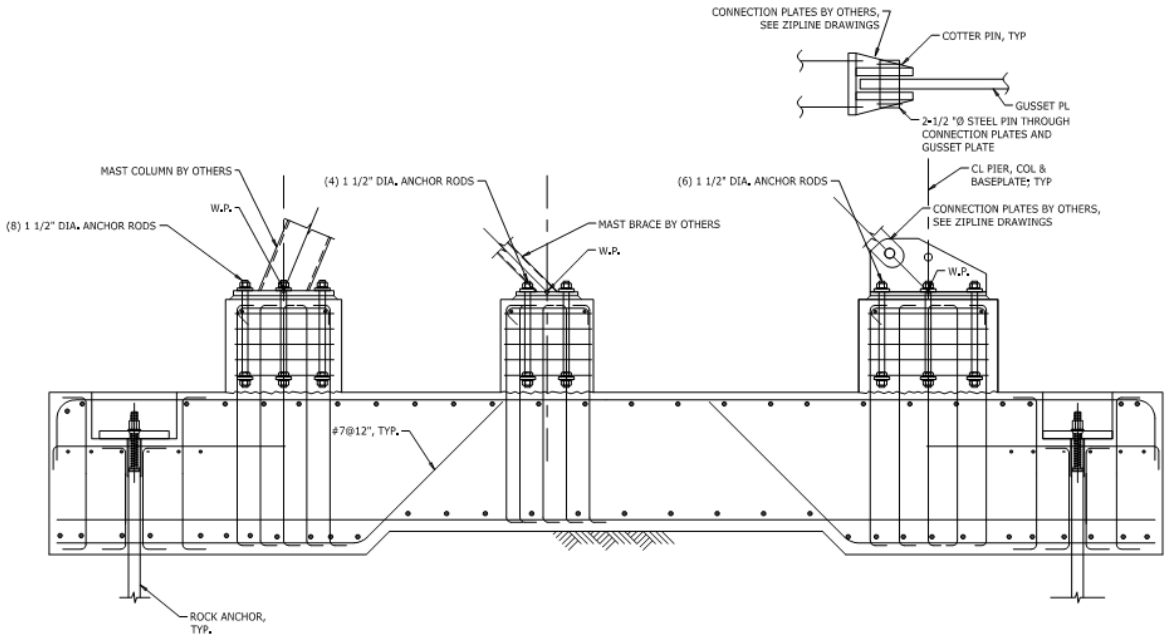
Zipline transfer truss reaction support strap connection to shear wall



View of take-off platform with space truss



Take-off platform column base anchorage detail



Mat foundation with rock anchors at landing zone

By signing, signatory agrees to the following and represents that he or she is authorized to sign for the structural design firm of record:

All entries become the property of DVASE and will not be returned. By entering, the entrant grants a royalty-free license is granted to DVASE to use any copyrighted material submitted.

If selected as an award winner, you may be offered the opportunity to present your project at a DVASE breakfast seminar. Would you be willing to present to your colleagues? ☑ ***YES*** ***NO***

Submitted by:

Print name: **Jason Squitiere, PE**	**Signature:** 	**Date:** **3/26/2021**
Submitting Firm:	**The Harman Group**	
Mailing address:	**150 South Warner Road, Suite 100** **King of Prussia, PA 19406**	
Telephone: **610-337-3360**	**Fax:** **610-337-3359**	**Email:** **jsquitiere@harmangroup.com**