ASP - BTS EQUIPMENT PLATFORM DESIGN CHECK

For
NT1010-0-0A Support Platform
Pensacola, Florida

Prepared For:

ADVANCED SUPPORT PRODUCTS, INC
Tomball, TX

By:

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Ray Ullrich, P.E.

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NT1010-0-0A BTS Equipment Platform

PROJECT DESCRIPTION: Calculation of loads for a typical BTS equipment platform, to be located in Pensacola, Florida. Loads are calculated as per ASCE7-98 and applied in a finite element model. The platform will be located on a rooftop. Rooftop or any substructure analysis is not in the scope of this analysis.

Applicable codes: ASCE7-98, Conforms to 1999 Standard Building Code, IBC 2000 & Florida Building Code (140 mph, 3 sec. gust)

INPUT DATA

-Structure Data- (data provided by ASP)

Maximum wind speed	$V := 140 \cdot mph$
Max. height from ground	$H_{rf} := 195 \cdot ft$
Building exposure	= "D"

Cabinets Dimensions-

Cabinet height	$H_{cab} := 6 \cdot ft$	
Cabinet width -total	$W_{cab} := 8 \cdot ft$	
Cabinet depth	$D_{cab} := 3.3 \cdot ft$	(at support points)

INPUT WIND LOAD PARAMETERS

Exposure "D" -section 6.5.6 - ASCE7-98

$V := 140$	mph - Basic wind speed (3 sec gust at 33') Fig 6-1 ASCE 7-98
$Cf := 1.2$	Force coefficient Table 6-11, ASCE 7-98
$G := 0.85$	Gust response factor for Exposure "D" category 6.5.8. ASCE 7-98
$Kz := 1.61$	Velocity pressure coefficient, Exposure "D" - table 6-5 ASCE 7-98
$Kzt := 1$	Wind speed over hills & escarpments Edn. 6-1 & Fig 6-2 ASCE 7-98
$I := 1.15$	Importance factor, Communication facility. Table 6-1 ASCE 7-98

CALCULATION

-Wind pressure-

$qz := 0.00256 Kz \cdot Kzt \cdot V^2 \cdot I \cdot psf$ $\qquad qz = 92.9\,psf$

-Wind load on the Equipment-

Calculate the effect of wind loading from the cabinet to the platform

Front $F_f := H_{cab} \cdot W_{cab} \cdot qz \cdot Cf \cdot G$ $\qquad F_f = 4.55\,kips$

Linear shear load $S_{clin} := \frac{F_f}{W_{cab} \cdot 2}$ $\qquad S_{clin} = 284.28\,plf$

Moment from wind load $M_{cab} := F_f \cdot \frac{H_{cab}}{2}$ $\qquad M_{cab} = 13.65\,ft\_kip$

Couple from moment at base $C_{base} := \frac{M_{cab}}{D_{cab}}$ $\qquad C_{base} = 4.13\,kip$ (up & down)

linear couple $P_c := \frac{C_{base}}{W_{cab}}$ $\qquad P_c = 516.87\,plf$

-Weight of cabinets-

Total weight of cabinets: 3100 lbs $WT_{cab} := 3100 \cdot lb$ Weight of platform

Cabinets will be placed along the angle supports. $WT_{pl} := 1311 lb$

$L_{sup} := 8 \cdot ft$

$WT_{cabuni} := \frac{WT_{cab}}{2 \cdot L_{sup}}$ $WT_{cabuni} = 193.75\, plf$

-Grating weight-

Grating (1"x3/16") $UW_{gr} := 7.6 \cdot psf$

Loading on the runners

Spacing $S_{out} := 2.43 \cdot ft$

$WT_{gr1} := UW_{gr} \cdot S_{out}$ $WT_{gr1} = 18.47\, plf$

-Live Load-

$L_L := 60 \cdot psf$ (unoccupied structure - use same as walkways & elevated platforms)

Loading on the runners

Spacing $S_{out} := 2.43 \cdot ft$

$WT_{Live} := L_L \cdot S_{out}$ $WT_{Live} = 145.8\, plf$

The above calculated loads are input in the finite element model. Refer to FEM printout for results.

From FEM output

Max. deflection $\Delta_{max} := 0.019 \cdot in$

Max member stress ratio $\alpha_{max} := 0.454$

Overtunring stability check

Overturning moment from wind $M_{OT} := F_f \cdot \frac{(H_{cab} + 1 \cdot ft)}{2}$ $M_{OT} = 15.92\, ft\_kip$

Resisting moment from weight $M_{res} := (WT_{cab} + WT_{pl}) \cdot 10 \cdot \frac{ft}{2}$ $M_{res} = 22.05\, ft\_kip$

$SF := \frac{M_{res}}{M_{OT}}$ $SF = 1.39$ < 1.5 NG. need additional ballast weight.

Additional ballast required

$$WT_{ball} := \left[\frac{M_{OT} \cdot 1.5}{\left(10 \cdot \frac{ft}{2}\right)}\right] - (WT_{cab} + WT_{pl}) \qquad WT_{ball} = 364.85\, lb$$

Provide 400 lbs of additional ballast $WT_{ball} := 400 \cdot lb$

Tiedown check

$w_{TD} := 2 \cdot in$ $t_{TD} := 0.25 \cdot in$ $F_y := 36 \cdot ksi$

Tie down - 2"x.25" plate Length $L_{TD} := 6.3 \cdot ft$ $A_{TD} := w_{TD} \cdot t_{TD}$

Check sliding due to wind

Coefficient of friction $f := .5$ Conservative

$P_{res} := \left(WT_{cab} + WT_{pl} + WT_{ball}\right) \cdot f$ $P_{res} = 2405.5\, lb$ $<$ $F_f = 4548.43\, lb$

Therefore platform weight is not enough to resist sliding loads from wind. Tiedowns needed. Provide tiedowns to resist the sliding forces.

Load to be resisted by tie down $P_{TD} := F_f - P_{res}$ $P_{TD} = 2142.93\, lb$

Building engineer to design new tie downs to carry the additional sliding forces.

From the results of the calculations, the NT1010-0-0A platform is adequate to support the proposed equipment for a wind speed of 140 mph, 3 second gust loading and the BTS equipment listed above, with the addition of 400 lbs of ballast and new tiedowns. The scope of this calculation is limited to the structural integrity of the steel frame of the ASP platform and does not include the load carrying capacity of the rooftop or any substructure where platform is to be located.