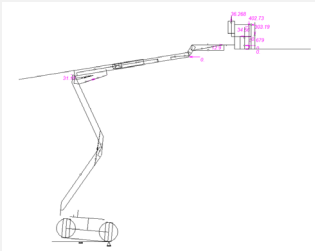


Summary

Project Name: : Stability Validation of AWP Machine

Software: Analytix, Lift tool

Scope: Stability study of AWP boom lift machine to check for the tipping and take appropriate measures to counter the over turning moments to avoid machine tipping.



- Analytix, Kinematic tool was used to study the stability of the machine. Model was parametrically built in analytix with corresponding weights and dimensions of the sub-assemblies to carryout tipping analysis for different configurations.
- Stability was verified for front, back and side tip cases.
- Kinematic multi variant lift tool was used to position the machine at multiple configurations (All possible positions) and verified for overturning and restoring moments wrt. tipping line.
- From the study, if stability index <1, Appropriate changes were made to design by positioning of weights to counter the turning moments.

		Tip Axes:	Xt =	0.0 in.	(0.00 m)
Information on Work Platform			Zt =	0.0 in.	(0.00 m)
	Platform Height:	(ZP) =	345.0 in.	(8.76 m)	
	Weight of Work Platform (less Boom Assembly):	(Gz) =	-12744 lb.	(-5780 kg)	
	Horizontal C.G. of Work Platform:	(XG) =	-44.2 in.	(-1.12 m)	
	Vertical C.G. of Work Platform:	(ZG) =	63.5 in.	(1.61 m)	
	Weight of Boom Assembly:	(Az) =	-1837 lb.	(-833 kg)	
	Horizontal C.G. of Boom Assembly:	(XA) =	109.1 in.	(2.77 m)	
	Vertical C.G. of Boom Assembly:	(ZA) =	332.6 in.	(8.45 m)	
	Moment due to dynamic movement of Boom	(MAy) =	35363 lb.*in.	(3995 N*m)	
	Projected wind area of Work Platform:	(AYzG) =	12284 in.*2	(7.92 m*2)	
	Vertical center of area of Work Platform:	(ZAYzG) =	162 in.	(4.12 m)	
	Shape factor of Work Platform:	(CG) =	1.40		
	Wind force on Work Platform = CG*AYzG*q:	(WGX) =	249.0 lb.	(1108 N)	
Information on Live Load					
	Total Platform Load:	(Pz) =	-396 lb.	(-180 kg)	
	Number of occupants:	(n) =	2		
	Weight of each occupant:	(Pnz) =	-176 lb.	(-80 kg)	
	Horizontal C.G. & Center of Area of Occupants:	(Xn) =	252.5 in.	(6.41 m)	
	Vertical C.G. of Occupants:	(Zn) =	345.0 in.	(8.76 m)	
	Vertical Center of Area of Occupants	(ZAn) =	384.4 in.	(9.76 m)	
	Moment due to dynamic movement of occupants:	(Mny) =	15736 lb.*in.	(1778 N*m)	
	Projected wind area of each occupant:	(An) =	1085 in.*2	(0.70 m*2)	
	Shape factor of occupants:	(Cn) =	1.00		
	Wind force on occupants = n*Cn*An*q:	(Wnx) =	31.4 lb.	(140 N)	
	Manual force applied by occupants:	(Snx) =	0 lb.	(0 N)	
	Horizontal Location of Manual Force:	(xSnx) =	256.4 in.	(6.51 m)	
	Vertical Location of Manual Force	(zSnx) =	388.3 in.	(9.86 m)	
	Weight of tools & accessories = Pz*(-n*Pnz):	(Pzz) =	-44.3 lb.	(-20 kg)	
	Horizontal C.G. of tools & accessories:	(Xz) =	252.7 in.	(6.42 m)	
	Vertical C.G. of tools & accessories:	(Zz) =	345.0 in.	(8.76 m)	
	Vertical Center of Area of Tools and	(Zaz) =	364.7 in.	(9.26 m)	
	Moment due to dynamic movement of tools &	(Mzy) =	1983 lb.*in.	(224 N*m)	
	Wind force on tools & accessories =C4*(-	(Wzx) =	1.3 lb.	(6 N)	
Moment calculations (My)					
	Resisting moment calculation				
	Gz*(XG-Xt)+Az*(XA-Xt) =	(MRy) =	362901 lb.*in.	(41002 N*m)	
	Live load moment calculation				
	n*C5*Pnz*(Xn-Xt)+Pzz*(Xz-Xt)+Pcz*(XPC-Xt)+Poz*(Xop-Xt)+Paz*(Xap-Xt) =	(MLy) =	-176775 lb.*in.	(-19973 N*m)	
	Wind moment calculation				
	-C3*(WGX*(ZAYzG-Zt))+Wnx*(ZAn-Zt)+Wzx*(ZAz-Zt)+WPC*(ZPC-Zt)+Wop*(ZAop-	(MWy) =	-77570 lb.*in.	(-8764 N*m)	
	Manual force moment calculation				
	-C2*Snx*SQRT((zSnx-Zt)^2+(xSnx-Xt)^2) =	(MSy) =	0 lb.*in.	(0 N*m)	
	Mass force moment calculation				
	-(May + Mny + Mzy + MPC + Mop + Map) =	(MMy) =	-68379 lb.*in.	(-7726 N*m)	
Stability Index Calculation					
	(MRy)/(MLy+MWy+MSy+MMy) =	(S.I.) =	>		1.124