

11th February 2003
Revised version



Discussion Paper

Effect of Anti-Lift Kit (ALK)

(Revised 11th February 2003)

by

Jakub Zawada

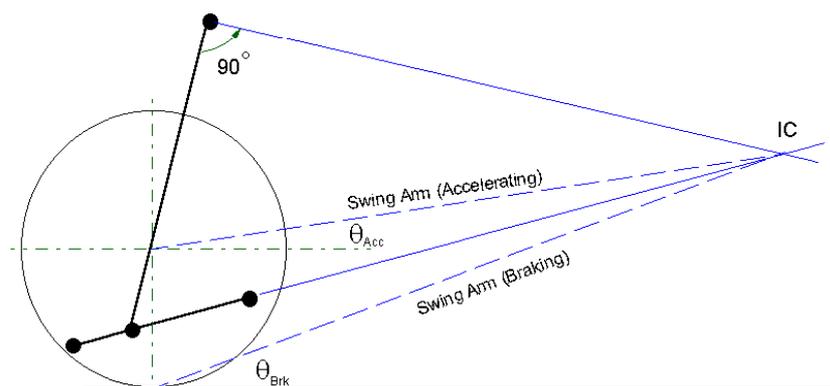
Effect of Whiteline Automotive ALK

The ALK effectively modifies the position of the side view instant center on the front suspension. The side view instant center is the pivot point for the side view swing arm (also the pivot point for the suspension at that instant), which is a line drawn from the tire contact patch to the side view instant center (under braking – for acceleration it is drawn from the wheel center). The slope or angle of this swing arm (effectively the position of the instant center) describes the amount of anti-dive and anti-lift present in the front suspension.

The instant center is found by the intersection of the two lines. The first is the projection of the lower control arm, say through the chassis mounts, behind the front wheel the second is the normal to the axis of the strut tower at the top of the strut, projected behind the front wheel in the case of the WRX.

(Note: To be absolutely correct these lines should be projected onto the wheel center plane, so any lateral angles in the lower control arm will effect the instant center position. However the lower control arm in the WRX is relatively flat which will give minimal effect)

The diagram below shows the instant center and swing arm.



11th February 2003
Revised version



Together with the position of the instant center, the WRX's wheelbase, CG height above the ground, % front torque (for anti-lift) and % front braking (for anti-dive) are required to calculate the anti features of the front suspension.

With the ALK fitted, the rear mount of the front lower control arm is lower by about 20mm. There is also a castor change by moving the mount outwards (however this has not been taken into account). This has the effect of lowering the instant center and decreasing the angle or slope of the swing arm resulting in the following anti-dive and anti-lift coefficients, expressed as percentages.

WRX with ALK			WRX without ALK (Without 20mm spacer)		
Wheel Base	2530	mm	Wheel Base	2530	mm
CG Height	600	mm	CG Height	600	mm
Front IC height	15.09	mm	Front IC height	426.63	mm
Front IC behind Front	11530.30	mm	Front IC behind Front	5456.88	mm
Front Angle to IC	0.0750	deg	Front Angle to IC	4.4704	deg
% Front Braking	70	%	% Front Braking	70	%
% Front Traction	60	%	% Front Traction	60	%
% Anti - Dive front (Milliken)	0.39	%	% Anti - Dive front (Milliken)	23.08	%
% Anti - Lift (Milliken) *	0.33	%	% Anti - Lift (Milliken) *	19.78	%
* Reversed Rear Anti - Lift			* Reversed Rear Anti - Lift		

As can be seen in the above spreadsheet, with the ALK fitted the anti-lift and anti-dive coefficients reduce to 0%.

11th February 2003
Revised version



The effect of lowering the % anti-lift / anti-dive

If the suspension has 100% anti-dive / anti-lift, then all the longitudinal load transfer experienced when braking and accelerating is carried through the control arm, leaving the springs unloaded and no deflection present. If there is 0% then the springs take the entire load, giving full spring deflection.

By lowering the % the front suspension becomes “softer” under acceleration or braking. This gives rise to the higher diving and lifting that has been experimentally shown. These results are shown below:

Whiteline ALK Test - 23/10/2002				
A	B	Ratio	mm	
98	74	0.755102	528.5714	
89	65	0.730337	511.236	
89	65	0.730337	511.236	
		0.738592	517.0144	
90	69	0.766667	536.6667	
87	66	0.758621	531.0345	
91	70	0.769231	538.4615	
		0.764839	535.3876	
A	700mm	Bottom of sill to black trim below door mirror		
B		Bottom of wheel to guard		

Conclusion:

A softer front suspension during acceleration and braking will even out the load on the front tires, giving a higher total cornering load available or more front grip. This will lead to less understeer when cornering under power or brakes.

Softer front rate will also allow better wheel tracking over rough roads, keeping the wheels in contact with the ground.

The drawback of these is the amount of pitch and roll increase that will be seen. This can effect the front suspension geometry if there is a very large amount of pitch and roll.