



The inimitable Mr Hogan

I first heard about Alan Hogan when I worked in engineering at Kenworth Trucks, about 20 years ago. The discussion I heard was about Mr Hogan's practice of bending steer axles to change the camber angle. I thought, don't the axle suppliers know how to set camber already? Apparently not. I heard that some customer-service guys occasionally took problem trucks to Hogan's Axle Corrections for rework.

The full answer to the 'camber controversy' became clear to me over the next few years. Camber settings need to be different depending upon the shape of, and side of the road being driven. To achieve excellent steer tyre wear, the camber on each side of the front axle needs to be set for conditions.

I recently arranged for Alan Hogan to talk to at ARTSA's Forensic Engineering Course. He has more than 50 years of experience of wheel alignment and axle settings on heavy trucks. Some of the key points he made were:

WHEEL ALIGNMENT

The real reason for doing wheel alignment is to stop tyre wear. You can't correctly align a truck that has worn steering parts or suspension bushes. The adjustments will not hold. If you let the steering and suspension parts wear beyond sensible replacement levels, the cost will be additional tyre wear. Perhaps 40 per cent of trucks need to have repairs done before the wheel alignment can be effective.

Rear beam axles set square. Some others change the rear axle squareness, which is a bandaid fix. Always set the rear axles square to the chassis. Don't be tempted to change this setting to correct pulling to one side. Correct the steer axle settings instead. It is a hazard to have toe-out because the truck tends to under-steer, which is a hazard on bends in the wet. More generally toe-in or toe-out will cause tyre wear.

CAMBER ADJUSTMENT

Incorrect camber causes uneven tyre wear. Typically wear on the inside of the right tyre and outside of the left tyre is due to incorrect camber setting. Road cambers differ on Australian roads. Road camber might be ¼ degree on a freeway-quality road and 1 ¼ degree on a single carriageway highway. Wheel camber adjustment is made to match the road camber. The camber settings are different on each side. Correct camber setting will probably double tyre life compared to standard overseas settings. Steer axles can be bent to change the caster. If you heat a forged axle, the strength will decrease. The axle must be bent cold. If you could see the 'grain in the axles beam', the affect of heat is to put knots in the grain. If the axle is bent inside the spring, then it will not sit up vertically. There will be excessive wear on the spring hanger and premature failure.

CASTER SETTINGS

Caster gives you directional control and feel of the road. Caster angle and kingpin

inclination work together. European trucks have greater than kingpin inclination than American trucks so the caster setting will be different on European and American trucks. The engine turns clockwise. This causes the front of the truck to left on the left side and so the truck tends to steer to the right. Australia drives on the correct side for the direction of engine rotation. For left steer trucks the caster angle is set higher on the right-steer wheel to counteract the effect of engine rotation. If these axles are used unmodified in Australia the truck will steer to the left. Therefore local axle correction is needed. For an American truck with multi-leaf spring, go to 4 ½ degrees caster but with parabolic leaf springs go to 3 ½ degrees. Too much caster on a parabolic leaf throws the weight to the back of the spring and gives a harsh ride. Too little caster on a multi-leaf gives a floaty feeling. A lot of guys put caster wedges in backwards on the right-hand side to change caster. Thus causes one rear spring hanger to wear faster than the other one. It also causes the truck to follow every channel in the road surface.

ACKERMAN GEOMETRY

The line through the middle of the kingpin and the middle of the tie rod end should pass just to the outside of the centre of the front differential. On a twin steer truck the steer arm settings will be different on each axle. The centre of the turn should lie on the centre line of the rear axle group. This



minimises rear tyre scruffing.

If the wheelbase is changed then the position of the tie rod end needs to be changed. Axle manufacturers may provide different attachment holes in the radius arm to allow various settings.

SUPER-SINGLE TYRES

Super-single tyres make the potholes on a bad road seem smaller and so the ride and tyre life can be improved. The steering set-up does not need to change when super-single tyres are fitted on the front axle. But the set-up needs to be 'spot-on' with super-single tyres or they will wear faster than a narrower tyre under the same conditions.

TYRES GENERALLY

Generally modern tyres are of good quality. Wear differences do exist between brands and even between different factories from the one manufacturer. Many problems arise from poor fit of the tyre to the rim. Tyre fit is paramount. Out-of round fit is the most common problem. If it is out of round, the tyre will wear on one side and it will shake the truck. Jack the truck up and spin the wheels. Out of round and wobbles will be obvious. Don't buy tyres that have a preferred direction of rotation. They can't be swapped from left to right sides. Tyre rotation can be done at 20,000 km, 50,000km and 100,000 km. Good tyre life is 150,000 km on the steer. Rear-axle tyres can achieve 250 – 300,000 km life.

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If you put a new tyre with a half worn tyre on a dual wheel, the half worn tyre will get a scalloping wear pattern. The tyres have slightly different diameters and the smaller one will 'let-go' periodically. This causes scalloping wear.

The things that cause tyre wear in order of importance are toe-in or toe-out, correct pressure for the load, leaking valves that waste tyre pressure, camber setting, caster setting, loose bearings or worn shock absorbers as well as non-standard wheel rim widths, which affect the contact patch shape. Nut tightness should be checked during the first journey after a wheel has been refitted.

STEERING MECHANISMS

Uni-joints in the steer shaft chain need to be correctly aligned, which is at right angles to the next one. Otherwise the wheel angles are disturbed.

The line of the kingpin must be inside the tyre contact patch and between the inner edge and the centre of the contact patch.

It's not legal to sleeve a kingpin any more. If you grease it every couple of weeks then water and dirt will be kept out and it should last for the life of the truck.

Offset wheel rims on the front axle: They put greater load onto the outer bearing and can cut the bearing life in half. Significant de-rating of the steer axle will apply.

TOE-IN & TOE-OUT

The steer wheels are close to but not quite tangential to the path. An angle must exist for the tyre to generate cornering forces. If the steering wheels have toe-in or toe-out, the steering angles are incorrect on each side and this generates different steering forces on each side. Steering performance is degraded. The vehicle tends to pull sideways.

The rear wheels get dragged around the path and this wears the rear tyres. The more axles at the back, the more dragging occurs. The shorter the wheelbase the more dragging.

Dr Peter Hart, Chairman