

## I tried to drive a trolley bus - by Derek Louw

*Note: we do not have any photos to illustrate this fascinating story, but there are pictures at the [Southern Africa Transport site](#).*

### **Johannesburg, 1975, and I qualified to drive trolley and diesel buses for the Johannesburg Transport Department (JTD).**

There were other issues of moment in South Africa (SA) at the time: apartheid was in full swing, although a year later in June 1976, the beginning of the slow end to the regime was to be marked by expressions of disquiet among school students in Soweto, and the draconian response from the authorities.

The country was feeling the effects of the economic recession for the first time for many years, as the oil price soared and SA began to feel the initial, if then sparse, effects of economic sanctions.

I returned to SA following a spell in the US, expecting to return to ample jobs in the land of milk and honey (as it was then if you were fortunate enough to be classified “White”), and found the milk and honey in short supply. There were no jobs, so, armed with the Extra Heavy Goods Vehicle (HGV) licence I had acquired some years back, I approached the JTD.

I don't remember the application process being demanding, and I had the advantage of the HGV, which effectively halved the training requirements as far as the JTD were concerned.

Bus drivers were required to have an HGV licence issued by the licensing authority (as it happened, another arm of the Johannesburg Municipality, of which the JTD was a department). The Public Service Vehicle licence (PSV) for municipal work only was issued by the JTD.

### **Services**

The JTD ran racially segregated services, mostly those for whites only on a radial set of routes from the city centre. The JTD ran a few routes for blacks. Where the routes coincided, as most did, there were separate stops for black and white buses, and separate terminal facilities in the city centre, those for blacks being, perhaps needless to say, not that close to the city centre.

White buses had white drivers, and although white crews had operated black buses at one time, by 1975 black buses had black crews, a testament to the growing difficulty of finding sufficient whites to do white reserved jobs.

The white routes were mostly one man operated (OMO) - no female drivers on the JTD at that time - using double deck Daimler Fleetlines and single deck Mercedes, although there were a few smaller classes. A few trolley bus routes had been converted to OMO by adapting the existing buses to forward entrance, rear exit.

The crew-operated routes were known colloquially as the “Louis Botha's” as they used the main road leading to the north - Louis Botha Avenue for all or part of their trip from the centre to the

outer terminals. The road was mostly four lane or dual carriageway, with two lanes in each direction.

Three of these were trolley routes: the 10 (Waverley), 13 (Highlands North) and 14 (Sydenham). There were two or three other less intensively operated diesel routes.

The trolley buses used in service were BUT Series 2 and Sunbeams, large 3 axle buses. The Sunbeams were very big, having a capacity of (I think) 128 seated and standing, often pushed higher in morning and afternoon peaks.

JTD also then had BUT Series 1, very similar in appearance to the later LT trolley buses, not used in service on white routes, but assigned to black routes (now that is a surprise). They were also used for training.

Crew operated diesels were AEC Mark 5's.

All these buses were rear platform entrance with driver's cab separated from passengers.

Occasionally, the Mercedes and Daimlers were used as crew operated buses on these routes, presumably a result of equipment failure on the older vehicles.

## Training

Drivers were type trained on all vehicles. Although there were different tests for the diesel and trolley buses, the driver had to pass both before getting out on the road with the PSV.

Once driver trained, route training followed. Route training was by "practice note", a list of all routes, which had to be signed off by regular drivers. The idea was that you took the note to a driver at one of the central terminals, and asked to drive the bus on that route. Some drivers were enthusiastic, others less so. Some simply asked if you knew the route, and signed the note.

The trolley buses were mostly crew operated, and you had a cushion, which you handed to the regular driver, so that he could make himself comfortable on the contactor box while you drove, and he passed on the various tips about how life could be made more comfortable for the driver without much reference to the rulebook.

Drivers were initially trained on driving only, and thus could only be assigned to the crew operated routes once passed. Some months later, of course, when passed for OMO, the driver had to remember all the routes from the practice note period.

This meant that the least experienced drivers, driving the oldest buses in the fleet, operated all the Louis Botha's with the added complication of some being trolleys. These routes had tight timings in peak and off-peak, and the result was some pretty manic driving on occasion, to the discomfort of passengers and (I suspect) the constant anxiety of the running inspectors.

A secondary effect was that many drivers did not like the trolleys, and left. In some cases, they were caused to leave following accidents with overhead wiring (and, on occasion, other vehicles).

## Driving the trolleys - the basics

The trolley buses were reasonably comfortable for the driver (if you ignored concerns about what might be going on above the bus between the poles and the wires). They had a full width and spacious cab, and unlike the AEC Regent 5, you did not have a diesel engine grinding away to your left, so they were quiet.

The cab was also cool in the heat of the noon sun (usually as apparent in Johannesburg's winter as in summer), but you might welcome the heat of the Mark 5 engine early in the freezing mornings.

The only noise was the buzz from the tyres, the clicking in the contactor box to the left, and the sounds of the clicking from the poles as they ran along the overhead. I always kept my driver's sliding door open so that I could hear the poles and motor noise.

## The trolley bus

The trolley bus is powered from overhead cables. Two poles on top of the bus are sprung upward so that they contact two overhead wires. The contact with the wire is via a pivoted sled at the top of the pole. The 660V DC (on the JTD) power runs down power bus cables and drives an electric motor through resistors, controlled by a contactor box in the cab. The electric motor drives the first set of rear wheels through a differential.

Providing the full 660V DC to the motor would provide a jack rabbit start and probably burn the motor out. The function of the contactor box is to divert current away from the motor on start up to resistors under the floor of the bus, so that power on start is limited. The BUT Series 2 and the Sunbeam had six and seven stage contactors respectively. They were supposedly equipped with "automatic notching", so that if you put the power pedal to the floor, they would automatically notch up and provide smooth acceleration to running speed. Forget it, they didn't.

Power pedal was on the left, brake to the right. That was about the confluence between the Sunbeams and the BUT Series 2. The former had a pump action handbrake lever on the left, the latter a conventional lever on the right. The BUT had a "soft" long travel brake pedal, which you could easily push to the floor, the Sunbeam a fairly hard short travel pedal, which required some pressure to get the air brakes to work.

The Sunbeams had very effective power steering, with a smallish steering wheel that required little effort to move, even if standing (bad practice). The BUT had no power steering, but a big wheel that moved easily once the bus was rolling.

Although driving techniques for the two types of bus were similar, and mostly dictated by the overhead, they differed in approach, not least as a result of the harsh pressure required on the brake pedal on a Sunbeam, compared to the relatively soft pressure on the BUT (and the tricks that followed from that). I deal with both types separately.

## Starting off

BUT: starting from stand: the school instructions were to engage the handbrake firmly, apply two notches of power, wait until the bus starts moving, and release handbrake, achieved by releasing the trigger grip on the handbrake to the right. There was slack in the differential, and unless you started against the handbrake (or when accelerating at low speeds) there was a whiplash effect that caused the bus to jerk. That may have been because these 20-year-old plus buses were worn, or it may have been a feature of the electric bus - the same consideration applied to the Sunbeams.

Wait until the motor hum seems to have stabilised (one of the reasons for having the driver's door open), and accelerate up the notches by pushing the left pedal and listening for the contactors running up in the contactor box. Don't, of course, do so, if the next traffic light ("robot" in South African parlance) is at red, since you will then have to nose-dive the bus to stop, which will certainly irritate standing passengers.

While it might seem pretty obvious that any driver should be watching road conditions ahead, the inexperienced (and I include myself in that in the early stages) could be so interested in actually getting the bus to run up smoothly as to fail to notice the red light until quite late, and heavy trolley buses did not really respond well to a quick move from accelerate to brake.

Of course, there was a non-school trick, readily passed on by the "older" drivers when on "practice note".

Rather than hauling back that heavy handbrake lever, it was much easier to push the brake pedal down a bit, so that the hand brake lever just fell back under light pressure from the right hand, and you left it fully applied against the ratchet, releasing as required.

You could go a bit further, and most did (another little trick passed on during "practice note").

Pushing the brake pedal to the floor applied the air brake firmly. There was an interlink between brake and power pedal. When the brake pedal was engaged, the power pedal was inoperative, presumably because there were two notches of regenerative/rheostatic braking at the top of the brake pedal travel.

But, of course, given that air brake release is delayed reaction, you could release the brake pedal, wait for the contactors to click through, and engage the power pedal, and the vehicle would take off smoothly as the air brake released. (I don't know what affect this had on the brake drums, but my suspicion is it cannot have been good). When accelerating from low speed (less than 15 km/h) you quite obviously couldn't pull this trick, and had to use the hand brake properly.

Sunbeam: the handbrake lever was on the left and had a pump action application that usually required three vigorous pumps to apply the brake. Release was a button on the top of the handbrake lever - hitting it with your left palm, a rather obvious means of release, was a good way of getting the fat of your palm rather painfully caught between the button and the top of the handbrake stalk - and I managed that a number of times, although the brake always released.

You could (and usually did, given the idiosyncrasies of the pump hand brake) use the hard air brake apply, a big push on the pedal in the Sunbeam, drop the brake pedal, and two notches on the power pedal - smooth start, as the air brake slowly released.

And then, as the BUT, listen for motor whine and notch up using the left power pedal as required. You could not rely on the “automatic notching” (indeed, we were told not to). Injudicious application of the power pedal could cause the overload “cut out” to operate. This could be hit or miss - some buses were much more sensitive than others, a detail you picked up over time. The load in the bus seemed to affect sensitivity, but that may have just been driver miscalculation.

## Overload cut out

Ah, the cut out and no power. You have just accelerated away from a traffic light with a (probably over full) peak hour bus going uphill and misjudged the motor whine as you apply a little more pressure to the power pedal, and there is a loud bang and the vehicle nose-dives, to the intense discomfort of standing passengers.

Unlike modern vehicles, which would probably require you to come to a stop before a re-set, in the BUT you grabbed a lever which popped out above and behind the left shoulder, twisted it and shoved it back in position. In the Sunbeam, there was a rod that poked out from the floor slightly behind you to the left, which you pushed back down. In both cases, you had to have your feet off the pedals to do so. Having done so, you got on with it. Which was, as the bus would be below 15 km/h, handbrake application to tighten the diff up and application of power to move on. This required a modicum of skill, to get the braking effect to do no more than tighten the diff, as you got the power back on, so the bus would accelerate forward smoothly: there were no “practice note” tricks for this exercise.

## Running

We were instructed not to run buses forward in two notches for any period - rather cut off and roll, because of the high risk that the under floor resistors used to shunt the current would overheat and burn (which happened, once or twice, but not to me).

The idea was that when up to maximum notch, and to speed (we were not supposed to exceed 50 km/h, which was the balancing speed of the bus on the flat), you released the power pedal, and allowed the bus to roll, re-applying power as necessary. I don't think anybody did that.

## Stopping

Stopping the buses was as most - apply the brake pedal and come to a stand, releasing as the bus stops to avoid drum brake nosedive.

Trolley buses are very heavy, and the brakes on these were necessarily big drums, most of the exercise being on the front wheels. The Johannesburg buses had regenerative/rheostatic ability. Initial application of the brake pedal on the Sunbeams and BUTs operated two notches in the contactor box. Nobody ever told me what the significance of this was, but I guess it turned the motors into generators and passed the current either into overhead or into the below floor resistors.

## The overhead

The bus only works if it gets power from the overhead. The driver needs to keep the bus more or less under the overhead wires. The trolley pole heads are roughly over the back of the bus, and you want to keep that more or less under the wires.

The rear of the bus can move about 12 feet either side of the overhead wire, but the more out of line you are, the greater the risk of dewirement. On straight sections, this is not much of a problem, but on curves or corners, more problematic.

One of the more useful (and legitimate) pieces of advice you picked up on practice note was to keep the back of the bus under the wires, as closely as possible.

The JTD system was old and worn by the time I worked it. It had also been installed when traffic was lighter, and the overhead did not necessarily follow the ideal path for bus travel, sometimes ranging across traffic lanes, particularly in curved sections, where you had to adopt care. The trick was to keep the bus under the wires when traffic conditions allowed, crossing lanes where necessary, or where not possible, constraining speed. Both made the trolley bus driver unpopular with other traffic.

Curves and corners in the overhead are made up of straight sections of wire, with curved castings to change the direction. Trolley bus drivers move over those at peril, usually slowly. Any deficiency, minor or major, will cause the poles to “throw”, leave the overhead, wave around all over the place, and require the driver to expend much energy in getting them back on track.

Similarly, running through point work at speed will cause poles to throw.

## Junctions

Where there is more than one route, there are junctions, where the overhead wire leads off to an alternative route, via a point or switch in the overhead.

After the switch point, the positive and negative overhead power lines cross. At that point, the straight route is isolated, the curved powered, so that as a bus running on the straight route went through, it would have no power for the short isolated stretch.

The points or switches were operated by electromagnets. The bus current operated the points - if the bus was taking power as it entered the point work section, that power operated the electromagnets, which moved the castings in the overhead to cause the poles to take the diverging route. If the bus was taking no power, the electromagnets did not operate, and the poles took the straight route.

When travelling on the straight route, one pole passed through the insulating section as it crossed the divergent route, giving a “no power” indication in the bus, a quick flick on the dewirement buzzer (see below) that told you that you were through.

As the JTD buses had regenerative ability, having your foot on the footbrake was not a great idea, as the back current would throw the points as effectively as the forward current. (We may or may not have been told that in training, but I certainly picked it up through experience).

The overhead junctions on the JTD system were such that on approach, the overhead diverged some distance before the road junction, so that the straight ahead and turn off ran parallel for some metres before the road divergence.

In most cases, there was a stop (all non-terminus stops were “request”) between the overhead junction and the road junction. The driver thus had to negotiate the overhead point, and be in a position to stop for passengers on the left side of the road. On the 14 (Sydenham) the driver had to leave the stop (if requested) and then manoeuvre into the outer lane to turn right.

The driving school approach was that you slowed to 15 km/h on approach to an overhead junction going straight, applied handbrake to control speed to 15 km/h (bear in mind that trolley buses roll freely) wait for the dewirement buzzer to tell you that the poles were through the insulated section, and then deal with stop or traffic light work.

If on the divergence, you slowed to 15 km/h, applied the handbrake, and gave two notches of power to energise the electromagnet in the overhead, so that the poles took the divergent fork.

In both cases, you might have to stop immediately after negotiating the overhead junction, so quite obviously you needed to know when the poles were through (thus the open driver’s door).

On the ground, though, hey, we have a bus service to run. Timings were tight, peak and off-peak, and we need time for the crew to grab a quick smoke at turn around. In practice, although PSV drivers were prohibited from smoking while driving, most did, but you still had the more publicly exposed conductor to think about.

So, if you approach a junction intending to take the straight-ahead, we often did not get down to the 15 km/h, and rather than messing with hand brake application (particularly on the Sunbeam, with its 3 vigorous pumps), you simply let the bus float through.

The driver had to be careful not to touch the brake until the poles clicked through the point work castings, and a short “flip” from the dewirement buzzer indicated that you are through the short insulated section on the straight path, and could then brake, if required. You would usually have either the stop or a traffic light to deal with.

Taking the divergent path on approach, the non-school technique was to get the bus down to around 15 km/h, give two notches of power (which did not accelerate the bus, as that was about the balancing speed), and not worry about the handbrake application. You then listened intently for the poles clicking through the point - no dewirement buzzer flip to give the indication that you were through, as on the straight, and you could then release the power pedal and deal with the passenger stop if required. Avoids messing with handbrakes, particularly the pump operation on the Sunbeam.

You had to get this pretty well correct, the power application had to be at just the right position to get the electromagnetic switch to operate, and not to have the bus accelerate, particularly if you then had to deal with a passenger stop within the next few metres.

Of course, if you got any of this wrong, the next section becomes relevant.

## Dewirement

The buses had two indicators for the power supply - the “dewirement buzzer”, an indication that the bus was receiving no power, a short buzz as you crossed an insulator, or a continuous buzz, either because the poles had “thrown”, or because there was a power cut (less frequent, but it happened); and the “Leakalarm” showing that electrical power was being disseminated where it should not be. We were told to stop and isolate the bus (by dropping the poles) if the “Leakalarm” sounded, and were told that the dewirement buzzer meant there was no power to the poles.

A nice short click or buzz from the dewirement buzzer was a useful tool in operating, as that told you that you were through a short insulated section, as in overhead point work or crossings. A long and mournful buzz was an indication that you had “thrown the poles”, or that the electricity supply had gone, which happened occasionally.

The overhead was powered in “sections” of varying lengths, with insulating gaps between sections. Drivers were supposed to cut off running through these insulators, to avoid sparking and burns.

I do not think that many did, although there were a few key points where the insulating gap was exactly where the bus would come to a stand without power and unable to move. Drivers were generally aware of those. There were one or two where the driver could get it wrong, and the bus would come to a stand in a position where it could not be rolled away. (Most of Johannesburg is not flat, so these positions were few), but where it happened the trick was for the following bus to give a little “nudge” and push the first bus over the gap.

The next trick for the following bus was not to manage to stop on the same spot - a not unusual occurrence.

### The antisocial trolley bus: pole throw

The dewirement buzzer also told you when the poles had “thrown”. This undesirable feature of trolley bus operation occurred most frequently at junctions or around sharp curves, where speed was generally restricted to 15 km/h. The restriction was both to reduce the likelihood of a pole throw, and to reduce the potential damage to the overhead (and adjacent buildings) that would be caused by the poles swinging forward as the bus stopped.

Pole throw could also occur on straight sections for no discernible reason, although I guess that that was probably because the springs supporting the poles were not properly set, and the various pressures on the system simply caused the pole to throw, usually when the bus was not quite under the overhead.

Once one pole went, it threw the other as well, and, of course, the instinct on hearing the buzzer going off was to slow the bus as quickly as possible, and both poles would slew around towards the front. The better technique would probably have been to allow the bus to run to a halt, so that the poles were splayed toward the rear, but I can modestly say I had no great experience of dewirements, and was unable to test these theories to any extent.



Once you were in the position of having a dewired bus, you had a bus in a traffic lane, with poles at various places. Usually, although they swung forward on the brake application, they were caught by overhead support, and were at 180 degrees or less to the rear of the bus.

JTD buses did not have a rope and pulley system controlling the poles, and the driver had to pull the bamboo cane out of its tube under the bus, and then use the hook on the end to fish the errant poles and get them back onto the overhead. The conductor had no obligation to help, and usually did not. While the task can look quite easy, it is not.

Dewirements in wet weather were rare, in my experience, probably because the rainwater acted as a lubricant between the runner on top of the pole and the wire. In hot weather, in Johannesburg, and in daytime, you have the sun more or less vertically, or sufficiently so that it is difficult to see the pole, never mind hook it with bamboo stick. You moved the bamboo pole hooked to the trolley pole round to the back of the bus. You then could not see the overhead wire against the sun (we didn't have Ray-bans, although I am not sure that they would have helped).

So you propped the bamboo pole, hooked to the trolley pole, up against the back of the bus, went upstairs through the back entrance, opened the emergency exit window on the upper deck rear, and then used the strategically placed bamboo pole to locate the trolley pole on the overhead.

And then did the same for the other pole. Fun, especially if you don't like heights, and I don't, even those from the top deck of a trolley bus.

## Overall

In skilled hands, the trolley buses were comfortable, clean, and quick, even though they were showing their age (as was the overhead). In less skilled hands, the relatively high power available, together with the very effective brakes, could make for a rough ride. The effect of the JTD policy in training drivers on crew only operated buses first was to put new and necessarily less-skilled drivers on the major trolley routes, with predictable results.

I tried to keep the ride smooth, and maintain timings (sometimes difficult) and was very pleased to have a conductor come around to me at the Highlands North terminal on the 13 after a run out of the city to say that this was the first trip he had done where he had been able to collect fares on the top deck.

I enjoyed the challenge of driving these buses, keeping to the tight timings and doing so while giving passengers (and conductor) a reasonable ride, and keeping the poles firmly on the overhead. After I passed out as OMO, I was assigned to diesel buses until a short return to the trolleys, on an OMO Melville, which was a bit terrifying, and of which more anon.

## Postscript: some observations on regenerative braking:

The regen/rheostatic brake effect has had me wondering over the years. I now know that regen could only work properly with some pretty sophisticated equipment in the power distribution network (see the many sites dealing with the issue on the Sheffield - Manchester Woodhead rail route), and JTD will not have had that. I do know that the application of the brake pedal caused an initial reaction in the contactor box, and that it could operate the overhead power frog if you were silly enough to have it on application as you ran through. I think we were told that in training and I achieved it once in training (probably on a "trick" exercise by the instructor), not in service. Other drivers had certainly been caught by the effect in service.

I now think that the way it worked was that it was regen into the wire if another bus was taking power from the section. Section power was to both northbound and southbound from one distributor. Given the topography, on rare occasions both would be on the flat, but mostly not. Provided there was another bus in section, taking power, the regen would work, but if not, I think it did not. I sharply recall working northbound down Louis Botha hill - one of the fairly steep descents - holding the bus to speed on the brake pedal contactors, rather than using the air-braked drums (I was never that happy riding the brakes on the trolleys on the descents, following a much earlier experience of brake drum fade on a truck - but that is a different story). All was fine until just as I approached the sharp reverse bends at the bottom of the hill, the electric braking effect disappeared, and the bus surged forward. Easily controlled by pushing the pedal further down to get some air brake, but not exactly what you want.

I think that what must have occurred is that a southbound (uphill) trolley left the section just as I approached the bends, and there being nothing to take the regen power, there was no (or little) braking effect. Which suggests that it was regen only, since the resistors should have been able to do much the same. The buses were old, and not always that well maintained, so it is possible that the shunt to the resistors was not working. Possibly (and right now, in retrospect) it occurs to me that releasing and re-applying the brake pedal may have encouraged the contactor box to shunt the power to the resistors, rather than the overhead - but that is a bit late.

It follows from the above (assuming that I am correct) that if there was no other bus in section, having the brake pedal applied when running through a power frog would have no effect, as there is nothing to draw the power, so the effect would be somewhat random.