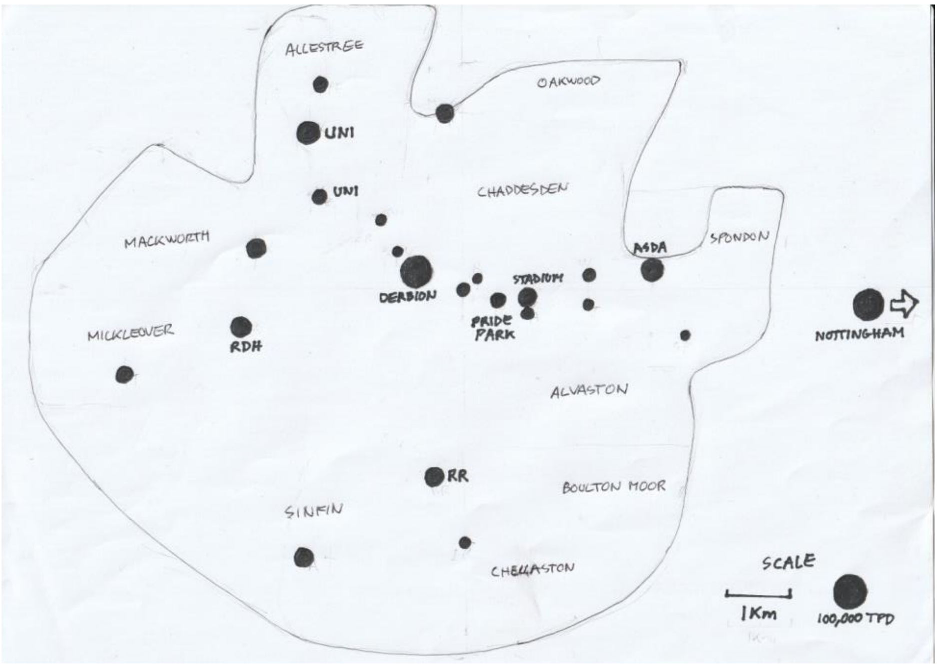
Derby Tramway Proposal.

Overview. Derby has low public transport use, only accounting for around 5% of journeys to work. The city centre is weak in terms of employment, most is outside in industrial sites and business parks. The city council aims to increase city centre employment in order to try and reverse the long term decline of the centre. Public transport in Derby is provided by buses operated largely by two companies, with little coordination. Buses are run “commercially” at the whim of the companies. This means that providing a public service is secondary to being profitable. Roads are congested, meaning bus services are unreliable and slow at peak times. Derby’s streets are largely narrow, with little possibility for effective bus lanes. A form of public transport largely operating off-street is required. A recent study showed Derby to have a high rate of health problems due to particulates, and a high rate of car use! All this needs to change, and an effective public transport system implemented. For a city of Derby’s size, this would best be provided by provision of a tram system to cater for the largest flows, with buses acting as feeders.

We need to take account of the largest traffic generators. The diagram shows these scaled.



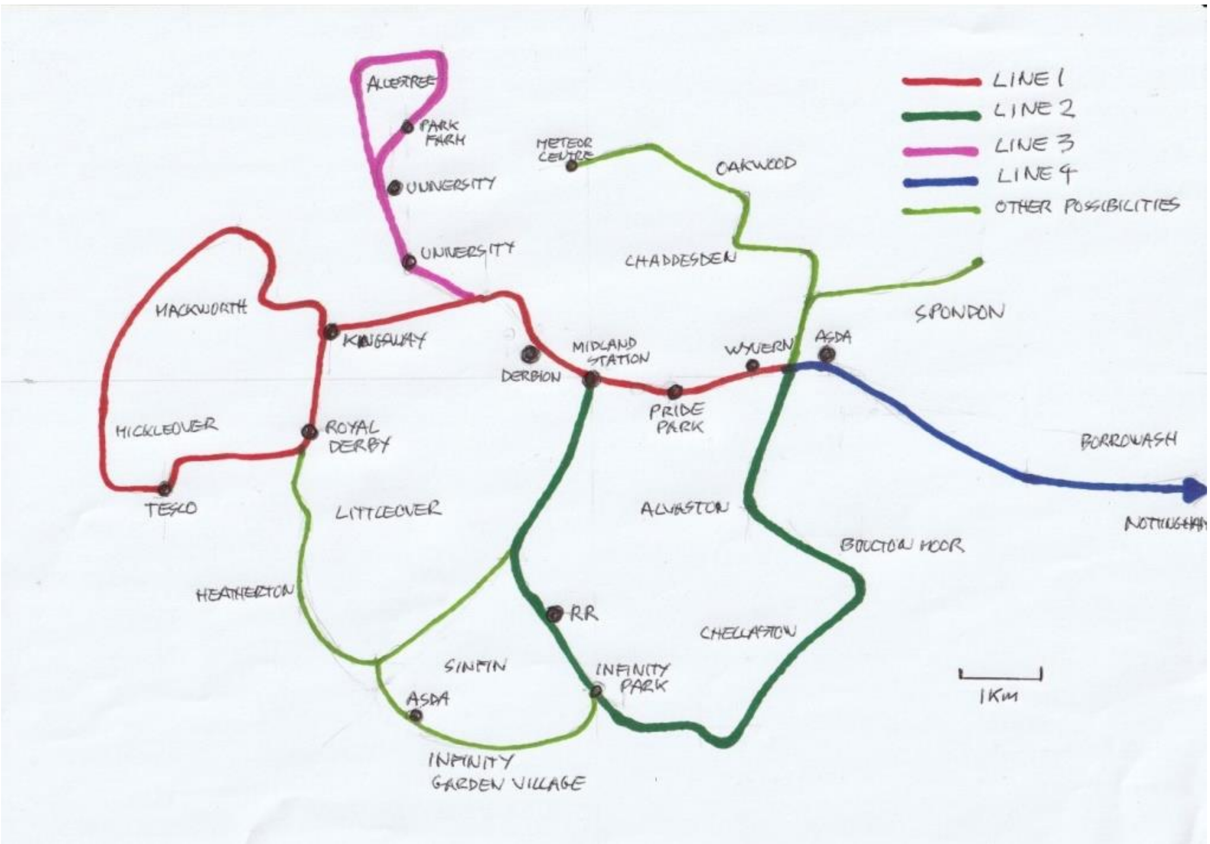
This shows that the main axis of destinations is east-west, from the Wyvern across the city centre to the Royal Derby and the University sites. However, to enable a much higher reduction in road traffic, we also need to serve RR at Sinfin, along with the growing Infinity Park. We also need to serve the major suburbs as much as possible. To be really effective, we need to identify routes that can largely be of-street, especially main roads. This gives better reliability, higher speed and reduced cost. Use of the old Great Northern alignment is the easiest one to implement, to give a route out to the Royal Derby, Mickleover and Mackworth, and this should be considered as Line 1.

RR could be served by a line following the Birmingham railway, and then the branch into the site. A lot of the old alignment onwards to Chellaston still exists, via Infinity Park, and should be used, and then extended through Boulton Moor and Alvaston, and then take Raynesway, using side reservation, to the Wyvern. This is Line 2. On the basis of taking a 20% share of traffic, easy for trams, which typically take over 25%, both of these lines would attain around 24,000 trips per day, most of this diverted from car use.

A branch off Line 1 could serve the University sites and much student accommodation, and extended into Allestree. This would go through the West End, with much off-street. This should attain around 18,000 trips per day, though this would involve less diversion of car use, as many of the users would be students. This is Line 3.

A connection to Nottingham NET would be desirable, and serve part of Spondon, Borrowash, Draycott, Breaston and Long Eaton to join NET at Toton Lane. This is Line 4.

A Phase One system would be Lines 1 and 4; this includes the hardest parts, the city centre, and a depot needs provision, a site on the Great Northern section is suggested. The next phase would be Line 2 and then Line3, both of these connecting with Line 1, and giving better utilisation of the depot and vehicles. The “network effect” would grow passenger use, as it would give much greater connectivity and travel opportunities.



Line detail.

Line 1. This includes many traffic generators, including Pride Park, Midland Station, City Centre with the Bus Station and Derbion, Joseph Wright College, University Law and Business Schools, Kingsway Retail Park and Royal Derby hospital. It would use the former GNR corridor out of the city, providing a fast and reliable journey out to Kingsway. At Kingsway the line would form a loop around Mackworth, Mickleover and the Royal Derby, taking in many new housing developments. This would be about 16.5 Km. On a basis of attracting 20% of trips, not high for trams, ridership should be around 24,000 per day. This gives 1,500 trips/day/Km.

Line 2. This serves the south of the city, covering RR, Infinity Park, and many other industrial sites on Raynesway, and the major suburbs of Chellaston and Alvaston, plus the rapidly growing new developments at Boulton Moor. This also would also attain around 24,000 trips per day. This line starts at Midland Station on Line 1, and would follow alongside the Birmingham railway out to Peartree, and follow some of the old Chellaston line further on, where available. It would then enter "mature" Chellaston, and then follow Snelsmoor Lane into Boulton Moor, and then into Alvaston via Shardlow Road, and then into Raynesway, on roadside verge, serving the industrial sites, and then go on to The Wyvern, re-joining Line 1. It would be 13Km, giving 1,850 trips/day/Km. Many of these will go on to Line 1, increasing its trip numbers considerably in the central area.

Line 3. This branches off Line 1 at Willow Row, going through the West End, serving much University accommodation, and via the Mackworth Recreation Ground to the University Markeaton sites. It would then go across the former Sturgess School grounds to Kedleston Road, and the Kedleston Road University campus. It would then progress beyond into Allestree via a loop serving much of the area. This would be 6Km, and should attain around 18,000 trips. It would be a relatively easy to construct line, and as a relatively short line provides a good business case, with 3,000 trips/day/Km. Much of this would also go on to Line 1, and some to Line2.

Lines 1 and 3 would do much to relieve A38 traffic, and would be a much better business case than the reported £650M for upgrading the A38, it would be much more environmentally friendly, and do much more for betterment of the city.

Line 4 This would leave Line 1 at The Wyvern, and would serve part of Spondon, Borrowash, Draycott, Breaston and Long Eaton. It would be 11Km, and should attain around 18,000 trips per day, and offer relief for the A52. This is Line 4. It would offer good connectivity for the Erewash communities to both Derby and Nottingham. Although city centre to city centre journey time would be longer than by express bus at off- peak times, it offers much better connectivity and destination choice, and reliability at all times. Rail offers faster station to station times, but is hampered by poor station siting, especially in Derby, mostly requiring further onward journeys to reach the required destination. The line would largely follow the old Sandiacre canal to Long Eaton. Long Eaton itself provides some difficulty, finding a good path to the town centre being a problem, as it is south of the canal path and the NET line. One possibility would be a delta junction, allowing services into Long Eaton town centre, as well as through Derby – Nottingham ones. This would be aided if the line was to be extended south into Sawley, and onwards to EMA. The trips/day/Km comes in at 1,600. Again, much of this will add to Line1 and to a lesser extent, Lines 2 & 3. The central section of Line 1 will end up with around 60,000 trips per day.

Park & Ride sites should be provided to serve the A38 and A52, and do a lot to remove local traffic from them in the city.

Bus Interchanges.

Buses should be reorganised to work with trams to give a complete transport system, the fare system should allow for both tram and bus use to complete a journey. Bus interchange facilities should be arranged at some stops, giving cross-platform interchange. Some bus routes should be configured to operate from interchanges into the local area, covering the local area away from the tram route. The tram routes should be designed to give as large coverage as reasonably practical, whilst not giving convoluted routing. Trams should operate on a core route to give fast and reliable service. Stops should be around 500m apart. All this is commonplace in mainland Europe, but not so much here; deregulation wrecked it outside London. The creation of the EMCCA should help here. Trams are more suited to longer journeys to outer suburbs, whilst buses will continue to provide services to most inner areas, where slow running doesn't give such a large time penalty. Buses should be electric, something which our local operators have so far failed to take up, to give a higher quality ride, and genuine reduced emissions. One operator makes very false claims of being ultra-low emission, seemingly only taking into account exhaust particulates! Ignored are CO_2, NOX and non-exhaust emission from tyre and road wear, which is now recognised as a major health issue. This latter of course still exists for electric buses, and with increased weight and higher acceleration, actually worse. Trams are free from this.

Construction Detail. Tramway costs very much depend upon the type of track used, from simple railway- type ballasted track on its own formation, to embedded street track, which is by far the most expensive. Work is being done in Coventry and elsewhere to reduce this cost by using a shallower track system to avoid necessity for diverting utilities, which is a large cost centre. Utilities are currently doing trials to see how they can work under such track. It is claimed that such track will cost around £3M/Km, a big reduction. It has been based around VLR, but is stated to also be suitable for "standard" trams. The highest loadings are not trams, but road vehicles. At the cheapest end, ballasted track, the cost should be around £1.5M/Km. In between is "grass" track in verges or reservations at around £2M/Km. This is for single track Km; and are for the track itself, other civil engineering is extra. High civil engineering cost would be in the provision of tunnels or bridges. Other cost is land acquisition and clearance to make way for the track, and diverting utilities where unavoidable. A compromise always exists between more civil engineering against allowing some disruption for utility work. Temporary track can be used in such circumstances, common in many countries, but not here. The loop nature of Lines 1, 2 and 3 would allow for operation from either side of an obstruction. Single track could be used in places around the loops, as services would alternate in direction to give better coverage, allowing inter and intra suburban trips. Other costs to be included are for overhead line (OLE) and power supply, vehicles and depot. The larger the systems, the lower these two latter are as a proportion, as more efficient use of resources is possible.

Phase one would be lines 1 and 4, which should cost around £300M, which is the cost of building the actual tramway, and allowing 50% extra for other costs such as site clearance, planning and design. The construction of a tramway is often the catalyst for public realm improvement; whilst very desirable, it shouldn't be accounted for as a direct tramway cost. Line 2 should come in at around £160M, and Line 3 £45M. It might be said that this would offer much more benefit for the area than the projected £650M for the A38 junctions scheme!

A good project management structure is necessary to keep costs under control; an "informed client" is required, with in-house engineering competence to avoid "gold plating" and cost inflation when lots of consultants, contractors and sub-contractors are used, each adding margins and contingencies. Edinburgh Phase 1 was a horrible example of where this takes you; Phase 2 was different and successful; and there are plans for more lines in Edinburgh.

Route detail.

Line 1. From The Wyvern to Midland Station would largely be on verges using "grass" track through Pride Park, giving environmental benefit and relatively low cost. At Midland Station, a bored underpass would be constructed beneath the station. An alternative is a bridge, but to cater for the excessive electrical clearances deemed necessary for future MML electrification, it would require long approaches. A less desirable alternative would be to use London Road bridge, giving conflict with road traffic. In this case, Deadman's Lane would be used as an exit from Pride Park; it would though serve the RTC Business Park before gaining the bridge. It would add around 1Km to the route. At the city end, the line would then go through Castleward on paved track to Traffic Street, and Derbion/Bus Station. Different paths from here are possible; Morledge – Market Place – Iron Gate – Cathedral Road; or Morledge-Albert Street-Victoria Street-Strand-Bold Lane. Either of these would enter Willow Row, serving the Joseph Wright College, and then take Ford Street and Friar Gate to then gain the old Great Northern alignment to Kingsway. It is a severe planning error that the bridge over Friar Gate has been blocked at both ends, preventing any further transport use. It would have been even much better if the original viaduct had been retained. Now, we have a problem in accessing the old GNR alignment. It will now have to come down to street level into Friar Gate and then turn into Ford Street, which will have to be crossed, giving potential conflicts. A subway may be necessary, as there will be trams every few minutes. On the GNR section, plain "open" ballasted track, the cheapest form of construction, and offering fast running would be used. From Kingsway the line would form a loop, clockwise going via the Manor Kingsway estate to the Royal Derby. This would be a mixture of grass and street track. Uttoxeter Road has to be crossed, either by a signalled crossing, or an underpass, to enter the hospital grounds. The line would go round the perimeter road, serving different hospital departments, and exit across Kings Drive via Severn Trent land and a small part of Wren Park school ground to Corden Avenue, using grass track. Using single track in places would reduce land take. From here, along Uttoxeter Road into Western Road to Station Road to serve "mature" Mickleover, taking Station Road back to Uttoxeter Road serving the Tesco superstore, and outwards and turn into the new housing developments. It would then thread through these using grass track on edge land and further parts of the Great Northern to Radbourne Lane, alongside the recently built and new developments, and into Mackworth Estate. Mackworth has a spacious layout, and much of the line can be on grass track, and the line would pass the district centre on Prince Charles Avenue and along Knightsbridge into Brackensdale Avenue, where it would go under the A38, and then re-join the other side of the loop at Kingsway.

Line 2. This would leave Line 1 at Midland Station, and run alongside the Birmingham railway out to Peartree. A lot of disused siding land exists along here, and the largely unused Peartree Station, which would be replaced by the tram service, but the railway would have to be crossed at Peartree, by a bridge or underpass. The line would then run alongside the branch line into the RR Sinfin site. It would then extend into Infinity Park, and along the old Chellaston railway where still available into

Shelton Lock, Chellaston, and then take to street and verge running into new housing at Boulton Moor, and onwards into Alvaston and then Raynesway using verge running, and then into The Wyvern, re-joining Line 1.

Line 3. This would leave Line 1 at Ford Street, and go through the West End, serving University sites and student accommodation and via Brook Street and wide walkways into Mackworth Recreation Ground, Mackworth Road, past the University Britannia Mills site and the Markeaton Street site, and then across the former Sturgess School land to Kedleston Road and the University main site. From here, verge running grass track would take the line to Birchover Way. Here, the line would form a loop, one side taking Birchover Way, passing Park Farm Shopping Centre, then Blenheim Drive, Askerfield Avenue to Kedleston Road, passing the new Kedleston Grange development, and back to Birchover Way. Most of this loop would be on verge grass track, some could be single track to save space. The loop would be bi-directional to allow local journeys, with services alternating in direction.

Line 4. This line would serve southern Spondon, Borrowash, Draycott, Breaston, Long Eaton and connecting with NET at Toton Lane. Much of this would be open ballasted track on the former canal route. The low land take of tramways would not prevent a possible canal restoration, much of the canal has been filled in, and provision of footpaths and cycle ways. Long Eaton presents some problems, it is desirable to serve the town centre, but this is south of the route. Long Eaton is a congested, busy town, and finding an alternative route may be difficult. One possibility would be to have a branch into Long Eaton town centre, with a delta junction allowing through Derby-Nottingham services, and others from both Derby and Nottingham into Long Eaton. In the longer term, this line could be extended to Sawley and East Midlands Airport.

These lines should eventually be added to; one obvious addition would be to serve Chaddesden, Oakwood and Spondon. A problem here is lack of many places to use off-road running. This means more street track, both more expensive and slower running. A way in would be a line alongside Acorn Way, and into Oakwood. This could be extended to the Meteor Centre. Off Acorn Way, street running will be required. A branch into Spondon off Acorn Way should be created, again largely street running. A loop could be created if a direct line from the Meteor Centre to the city centre was to be constructed, but the economic case is probably not good, but future development might render it suitable.

Another possible line would provide a sub-loop connecting Sinfin and Sunny Hill, taking in the proposed Infinity Garden Village. Another sub- loop could connect Sunny Hill via Heatherton to Line I at Corden Avenue. These latter would be relatively easy to build, but the network effect would give a much better coverage, and higher ridership on the whole system. This would further reduce road use and ease congestion and pollution.

Lines 1 and 4 should be considered the basis for the initial system, it would be used by other lines in the central area, and have depot provision, suggested situation on the Great Northern section. They would greatly reduce car traffic, and more so if Park and Ride was provided for the A38 and A52. Line 2 should follow; it would do much to reduce car traffic to RR and the many other industrial sites it would serve. Line 3 should be next, it would be relatively easy and cheap to construct, not requiring much civil engineering.

If all these possible routes were built, it might mean a strain on the central section, and an alternative route to be provided, as has been done in Manchester. Just think what around 100,000 passengers a day gliding through our city centre could do for its economy! Trams operate very successfully in pedestrianised areas, their predictable path, low noise and no emissions make them good neighbours.

Service Provision.

To provide an attractive "turn up and go" service, a maximum interval of 10mins is desirable. Stops should be around 500m apart – a compromise between accessibility and speed. Trams have a high, but smooth, acceleration rate, and multiple doors give low dwell times, and largely being off-street give fast and consistent overall journeys. Cross-city routes should be provided, but good interchange is essential, the latter also involving bus connections at key points. Hospital and university connections between Derby and Nottingham would indicate that Lines 1 and 4 should be linked. Similarly, Lines 2 and 3 being linked give a through north –south possibility, connecting residential areas with RR and the university.

TramTrains.

Derby has a very low use of rail for commuting, the poor siting of Midland Station making it unattractive for local use. This could be improved by use of tramtrains which can operate on the main line railway as well as on tramways. The Matlock line could be a candidate for their use, giving relief for the A6 corridor. There would be a connection from the railway to the tramway, the position of this to be decided. A connection in the south could offer services to Burton and Uttoxeter. A possibility for the latter is use of more of the old GNR, connecting with Line 1 in Mickleover; this would serve Etwall and Hilton and the Toyota site.

Vehicles.

Trams of a similar size to present Nottingham ones would be used, with a capacity of around 200. However, the use of Derby-designed technology, in which I must declare an interest, would deliver many improvements. This involves use of Wheelmotors, which have a very efficient, light-weight motor built as an integral part of the wheel. Each wheel can operate at different speeds, and so can be made to steer round curves, eliminating the need for bogies and giving a very large weight and space reduction, as well as a considerable reduction in track and wheel wear. They are also characterised to be able to recover about 60% of input energy when braking. Railed vehicles operating at moderate speeds, such as trams, have a very low rolling resistance, so most of the input energy is used for acceleration, and with Wheelmotors, most of this can be recovered. This would be helped by use of a small energy store on board, such as supercapacitors or possibly batteries; the heavy currents due to acceleration and braking would be kept out of the power network, which could therefore be considerably reduced in rating and size. As well as reducing energy use, the low peak currents would also reduce Maximum Demand charges, which can be higher than the actual energy cost! A power consumption of around 1KWh/Km/200 passengers should be attainable. Wheelmotors have been successfully trialled in Blackpool and on the Ecclesbourne Valley Railway. It would of course be good if the trams themselves were to be built in Derby, as indeed the first NET trams were.

Building this tram system would do much to improve Derby, mobility would greatly increase, and environmental degradation reduced. Air quality would be increased, it is often not recognised that non-exhaust-emissions, NEE, from the wear of tyres and road surface, are an extreme health risk, and that conversion to electric road vehicles actually makes them worse due to higher weight and increased acceleration rate. We have had sixty years of planning just for private car use, with public transport disregarded, and just left to private bus companies to provide a service at their own commercial consideration. All new housing and industrial sites should have provision for a future tramway built in. This can be by the provision of central avenues, the trees and grass giving a great environmental uplift, as well as good transport provision. Wythenshawe in Manchester was built with this in mind – it took ninety years for the trams to arrive, but they are here now, and very good! Here, Mackworth was built with public transport provision in the 1950s, in this case trolleybuses, but these were foolishly discarded in 1967, it's now time for something better!

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