FLARES AND GIVEWAYS AT SIGNALLED ROUNDABOUTS

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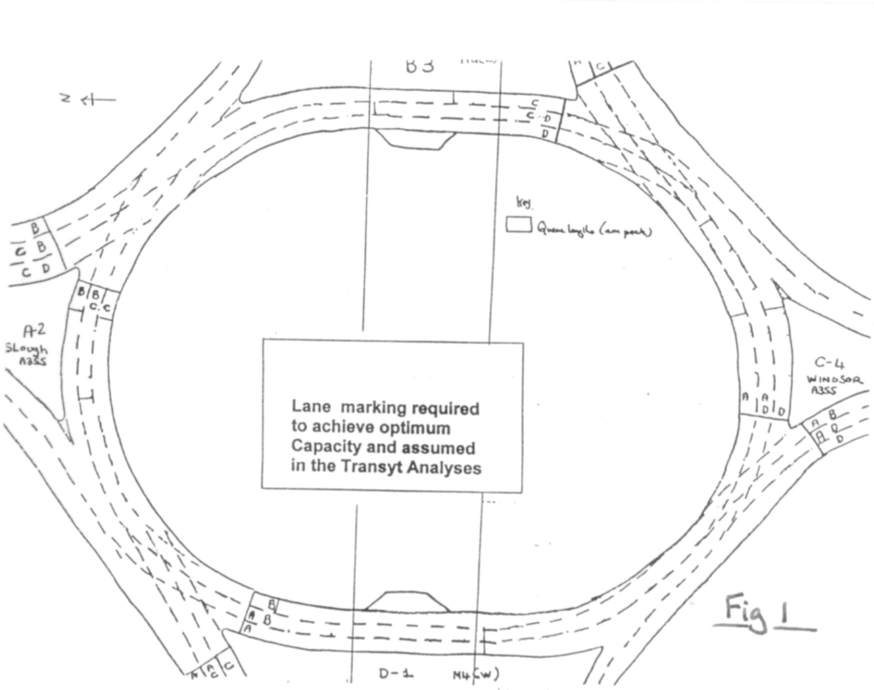
To signal or not to signal? There is no doubt that significant benefits, both to capacity and co-ordination can be achieved by leaving one or more of a four, five or six arm roundabout unsignalled. That is not to say full signal control may not be the 'best' solution in some incidences. For example, the roundabout shown in Figure 1 is typical of many motorway off-slip grade separated type roundabouts recently signal controlled in the UK. The demand flows on this particular roundabout were significant from all four entries and leaving one entry as giveway was not an obvious option. However, when more than three arms are signal controlled, it is probable that at one or more entries , some of the newly entered traffic will be stopped at the first stopline in the gyratory.

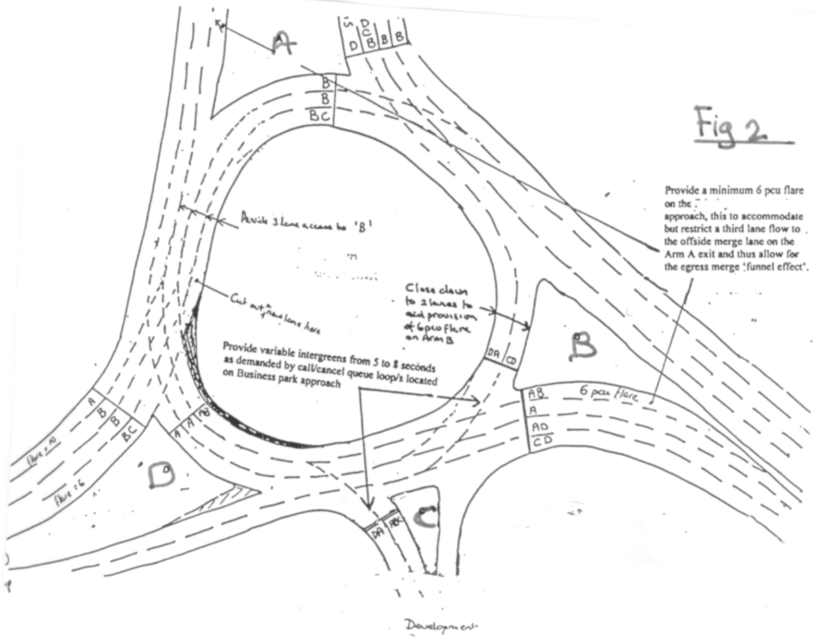
There is no magic rule book but I offer the following guidelines as an aid:-

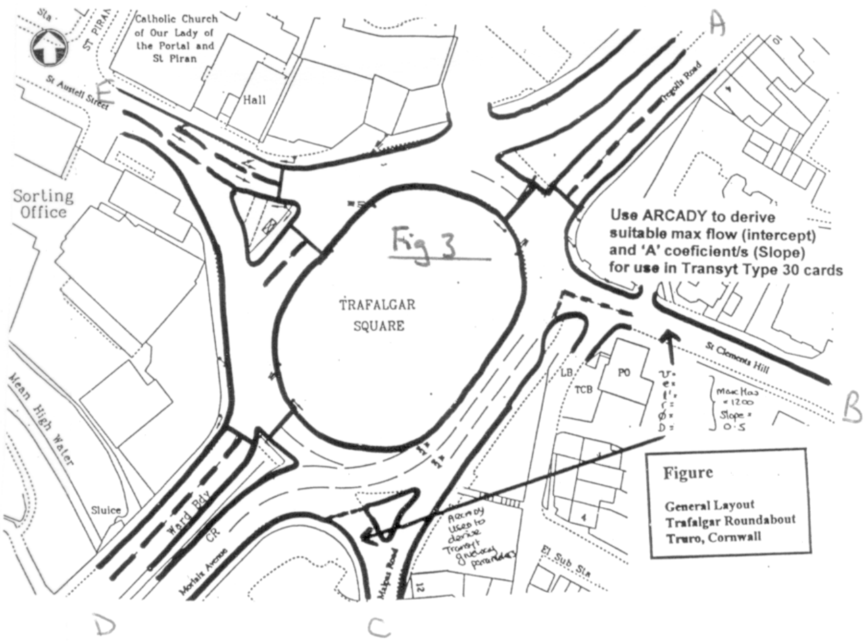
Consider leaving an entry as giveway if/when:

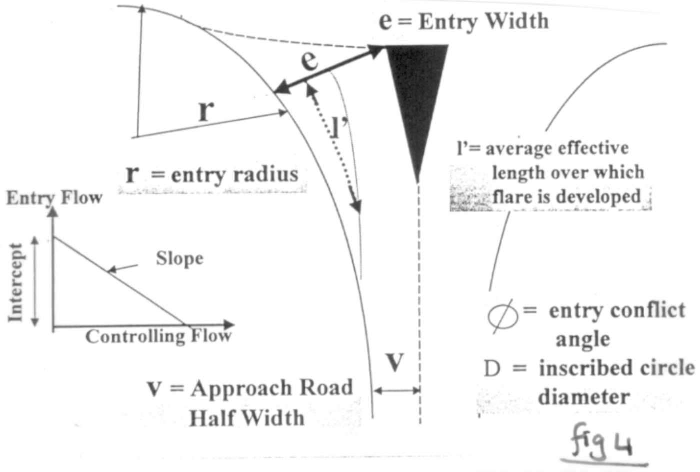
- *There is a low entry flow (i.e. < 900 pcu/hr) and sufficient stacking room for the gap-seeking traffic at the next stopline in the gyratory;*
- *Signalling will mean requiring three stages – avoid at all costs! (see Figures 2&3). If the reason given for demanding signals at a third entry at a gyratory junction is peestrians, look for alternative paths across the roundabout and/or consider a pelican on the entry about 25-30m before the giveway line. A three stage junction within a gyratory will generally prevent achieving good let alone workable co-ordination around the roundabout;*
- *In unclear situations, try Transyt runs with/without signals at entries and evaluate the results using the Transyt graphs to decide if one or more junctions might be left as giveway;*
- *Do not signal all entries simply because you are 'told to do it' – you are the paid experts, evaluate the situation and where it is clearly detrimental to signal all entries, produce evaluation results and communicate to your client that a better (and often cheaper!) result is sometimes achieved by not signalling.*

Figure 2 opposite demonstrates a case in point regarding pressure to signal all entries. The client (Arm C), who incidentally, often is obliged to contribute to the signals, was reassured regarding the decision to not provide signals at Arm C (which would have introduced a 3-stage junction) by the promise to provide call/cancel queue loops in the giveway approach that would extend the upstream intergreen/s should this at any time prove necessary.

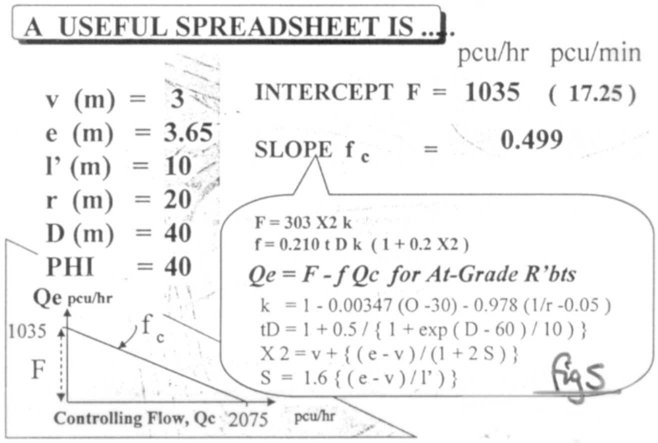






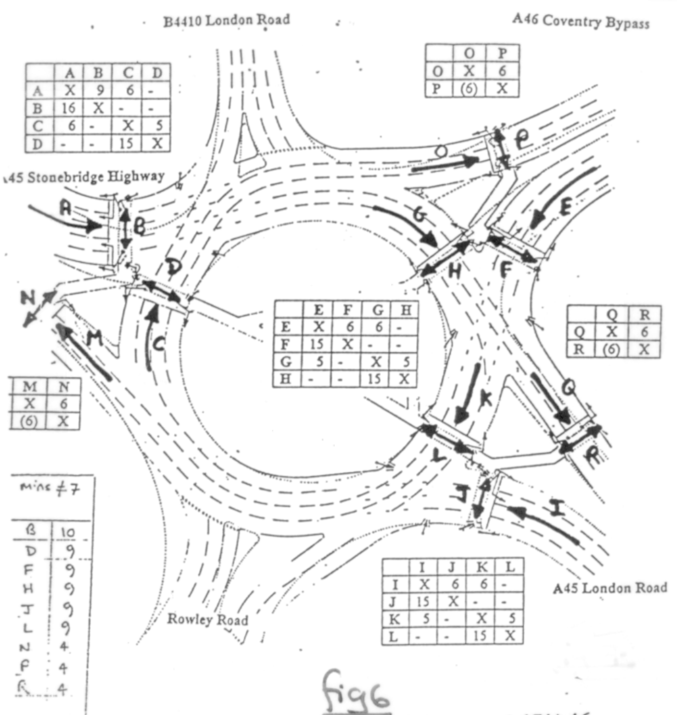


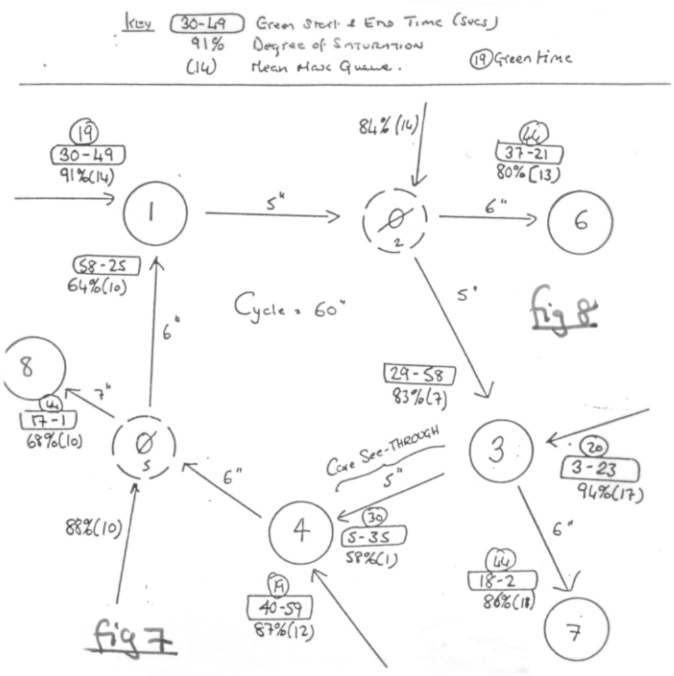
USER - SPECIFIED GEOMETRIC PARAMETERS USED BY ARCADY TO DERIVE INTERCEPT AND SLOPE RELATIONSHIPS FOR EACH ARM



How do you model giveway junctions in a signal controlled roundabout?

This is achieved by deriving ARCADY type 'Intercept' and 'Slope' parameters for the giveway approach. Remember to model only the road space on the approach that is regularly utilised . Figure 4 above illustrates the geometric parameters that need to be measured to derive intercept and slope. Figure 5 illustrates the TRL empirical formula into which these parameters have to be fed to derive the Intercept and Slope values. In Transyt, the intercept and slope values are entered using a card type 30. At multi-lane giveway approaches, derive the intercept and slope for the whole of the utilised approach, then divide both intercept and slope by the number of lanes to get intercept and slope parameters per approach lane (or link).





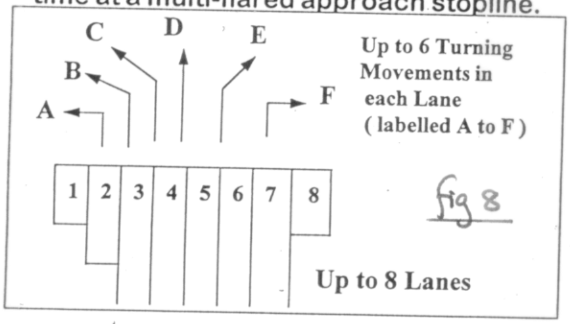
Phase and Intergreen Diagram A45/A46

Another Case Study

On first examination of the roundabout shown in Figure 6, it appeared that all entries would have to be signal controlled to achieve client requirements for good pedestrian access all round the roundabout. Since early calculations clearly indicated full signal control could not work, more complex solutions such as providing a 'throughabout' were considered. However, a much cheaper and simpler solution was soon found whereby two of the five arms were left as priority junctions, and the pedestrian needs at these two arms were satisfied by provision of closely associated crossing points at all other arms and by new pedestrian routes across the gyratory itself. The Transyt results, illustrated in Figure 7 indicate a most satisfactory result.

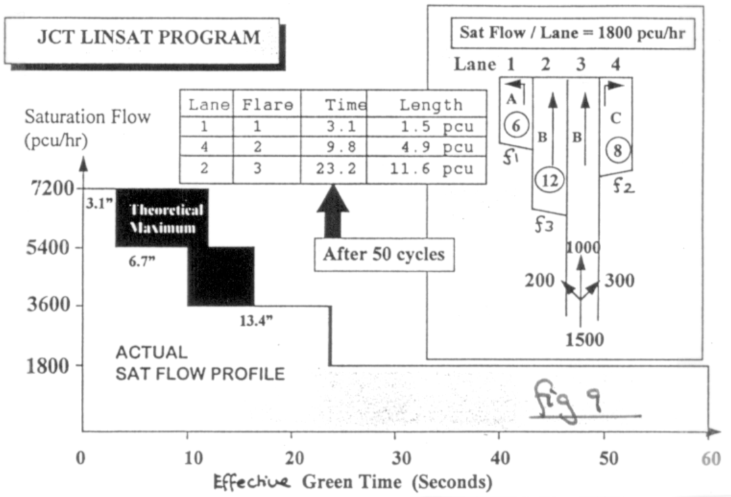
JCT LINSAT PROGRAM

LINSAT derives the average saturation flow after a specified length of green time at a multi-flared approach stopline.



Lanes are numbered consecutively from 1 starting at the nearside.

Permitted movements in each lane are labelled A to F where A is the first left turn starting at the nearside, and movements B to F are further movements measured clockwise from A



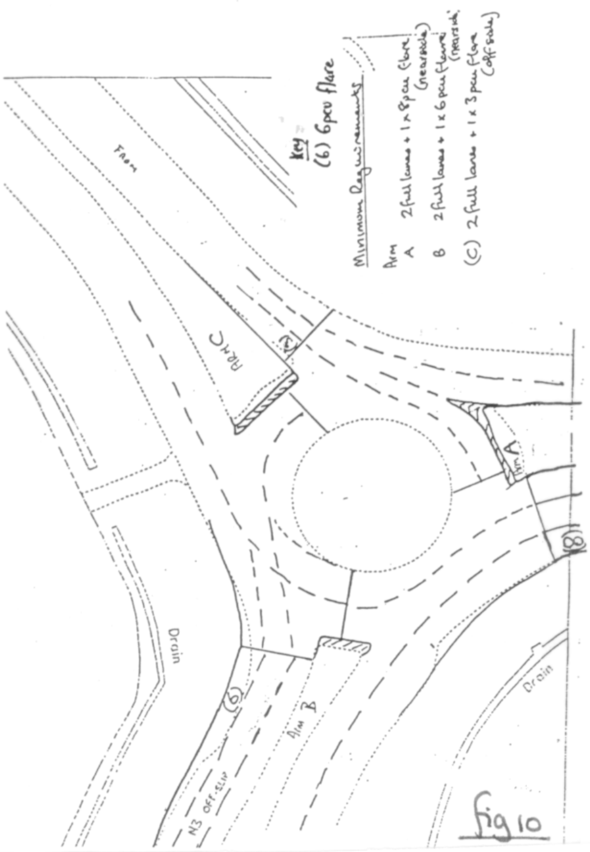
Flared Approaches:
Two issues have to be carefully addressed at flared entries to signalled roundabouts:

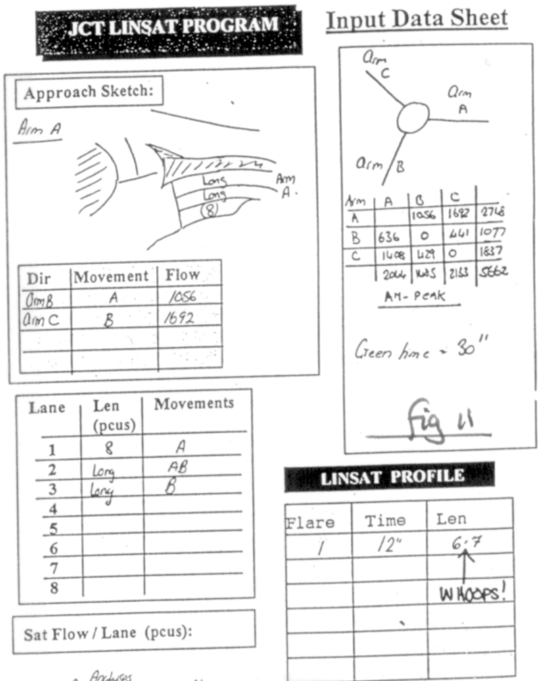
a) Required design usage of flare (derived by examination of your Lane/Flow Diagra

b) Whether blocking on the approach prevents achieving design usage

c) What length the approach flare/s need to be to achieve design usage

The JCT LINSAT program is particularly useful in checking (b) and (c) above. In the example given in Figure 9, LINSAT demonstrates that whereby the modeller may have specified usage as lane 1=6pcus, lane 2 =12 pcus and lane 4 = 8 pcus, when you simulate traffic arrivals on the approach over many 'trials' using LINSAT, you will see that due to 'blocking' the achievable result is lane 1 = 1.5 pcu usage(not 6), lane 2 = 11.6 pcu usage and lane 4 = 4.9 pcu usage (not 8). Unless blocking is accounted for in the derivation of entry capacities, Transyt and other modelling techniques, will give an over –optimistic estimate of capacity and hence likely queueing at flared signal controlled entries.





Analyses
Assume 8pcu use flare
Linsat Design Check shows flare length will need to be 10pcu = 60m to achieve regular usage by 8pcus – Care!

What length do the approach flare/s need to be to achieve design usage?

In Figure 10, the design for testing full signal control required that usage of the nearside approach flare on Arm A would regularly service 8 pcus/cycle. When this was tested in LINSAT regular usage (due to blocking' was estimated at about 6.7 pcus. Using LINSAT to determine how long the flare would have to be to achieve regular 8pcu usage despite blocking, the result was 10 pcu length, i.e. 60m usable flare queueing length.

Such issues are important when advising clients how long the approach flares need to be. Land take to provide additional flaring can be expensive, so you want some confidence and therefore methodology to check that the length you specify is the correct length at the outset!