

# LEVEL OF SERVICE F: IS IT REALLY AS BAD AS IT GETS?

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## ABSTRACT

Most delegates will be aware of the current definition of levels of service, from A (being very good) to F (being poor). In congested environments, I suggest that the current definition of level of service F is unhelpful.

- ◆ Firstly it gives the impression that a site with level of service F will experience severe congestion, when in fact it may be no worse than much of the surrounding area;
- ◆ Secondly, it is too broad a definition, as it relates to any site that is predicted to operate at over 100%. This is unfortunately becoming more common, so some "sub definitions" would assist.

This remit provides examples of the current problem, then suggests the development of a new level of service category, which should either be termed F+ or G. It also reviews current level of service targets within New Zealand.

## INTRODUCTION

This paper is set out as follows:

- ◆ It provides the current definitions of level of service F;
- ◆ It considers the implications of this current definition and suggests a way forward;
- ◆ It also considers the issue of level of service targets.

## DEFINITIONS

Level of service can be used as a measure of performance of the road network. It generally involves a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to manoeuvre. There are six levels of service, with A representing the top level as a condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream and F representing the worst level.

A definition of level of service F is as follows:

*“Level of service F is in the zone of forced flow. With it, the amount of traffic approaching a point exceeds that which can pass it. Flow break-downs occur, and queuing and delays result”<sup>1</sup>.*

There are a variety of ways of defining level of service. They include average speed, delay at intersections, degree of saturation at intersections and the density of vehicles/kilometre.

### Urban Streets

The Highway Capacity Manual (HCM) provides criteria for the level of service for urban streets based on average through-vehicle travel speed for either a segment of road or for the entire street under consideration. The average travel speed includes the running times on the roads plus the control delay of through movements at signalised intersections. Level of service is defined by comparing the congested speed against the free flow speed, and the definitions of level of service F are set out in Table 1.

Table 1: Definitions of Level of Service F for Urban Streets<sup>2</sup>

Typical free flow speed (km/hr)	Range of free flow speeds (km/hr)	Average speed for Level of Service F (km/hr)
80	90 to 70	< 26
65	70 to 55	< 21
55	55 to 50	< 17
45	50 to 40	< 14

### Intersections

The most commonly used measures used to assess levels of service at intersections are delays and degrees of saturation. Definitions of level of service F at intersections are set out in Table 2.

<sup>1</sup> AUSTRROADS Guide to Traffic Engineering Practice – Part 2: Roadway Capacity (1988)

<sup>2</sup> Highway Capacity Manual (2000), Exhibit 15.2

Table 2: Definitions of Level of Service F for Intersections

Level of Service Criteria	Intersection Type	Level of Service F
Delay per Vehicle	Signal Controlled intersections <sup>3</sup>	> 80 seconds
	Roundabouts <sup>4</sup>	> 80 seconds
	Stop and Give Way intersections <sup>5</sup>	> 50 seconds
	All intersection types <sup>6</sup>	> 70 seconds
Degree of Saturation	All intersection types <sup>7</sup>	> 1.00

## DISCUSSION ON LEVEL OF SERVICE F

The main issue considered by this paper is that level of service F is the lowest category defined, and therefore is in theory “as bad as it gets”. However, in our larger cities (and I am considering Auckland in particular) congestion is widespread and conditions are regularly categorised as level of service F. As such, the lack of further categories (i.e. levels of service worse than F) means that the term is fairly meaningless. Examples of the implications include the following:

- ◆ I have recently been involved in assisting North Shore City Council to develop its priorities for funding in its forthcoming ten year plan. Much of the network was predicted to operate at level of service F, and it was very useful to develop a category which we called LOS F+, for intersections with delays of more than 3 minutes. Incidentally, we set lower threshold targets (i.e. lower delays) for buses and commercial vehicles compared with those for general traffic in developing suggested priorities.
- ◆ The Environment Court appears to appreciate information based on accepted level of service criteria. However, I was involved in a case in 2006 where the Court was told that the level of service was F in 2006, it would be F in ten years time without development and F in ten years time with development. This was clearly “not helpful”.
- ◆ In considering the suitability of development relative to the timing of infrastructure, it is often useful to suggest that the infrastructure will be required when the level of service reaches a certain category. If it is already F, then clearly there is a need for alternative criteria.
- ◆ The final point is just the impression that is given to lay people when they hear that a certain stretch of road is expected to operate at a level of service F – being the lowest category possible. I have heard the term used “this is as bad as it gets.”

In reality a complex signalised intersection running on a long cycle may well get the vast majority of all road users through during a single cycle, but the level of service could be F, according to the definitions set out in Table 2. This situation should not be put in the same category as a bottleneck where traffic takes, say, 20 to 30 minutes to pass through a bottleneck. This may not be a common problem for much of New Zealand but it is clearly becoming a more widespread problem in the larger cities.

I am not saying that LOS F (or F+) is necessarily acceptable. I am saying that the current definitions are inadequate and levels of service F or F+ are likely to become more commonplace if congestion continues to increase.

<sup>3</sup> HCM (2000), Exhibit 16.2

<sup>4</sup> SIDRA User Guide (2006), part 4 page 85

<sup>5</sup> HCM (2000), Exhibit 17.2 and SIDRA User Guide (2006), part 4 page 85

<sup>6</sup> Roads and Traffic Authority, New South Wales (2002) “Guide to Traffic Generating Developments”, Table 4.2

<sup>7</sup> SIDRA User Guide (2006), part 4 page 85

## LEVEL OF SERVICE TARGETS

A secondary issue for this paper is what level of service should be targeted.

### International Targets

Traditionally, levels of service C or D are taken as the desirable levels of service and for example, the HCM states:

*"Most design or planning efforts typically use service flow rates at LOS C or D, to ensure an acceptable operating service for facility users"<sup>8</sup>.*

A target level of service of C is suggested in the RTA Guide for weekdays on rural roads, with a level of service of D for the recreational peaks at weekends, but for urban situations the Guide does not indicate a target. Indeed it notes that location is important, and states:

*"For example, drivers in inner-urban areas of Sydney have a higher tolerance of delay than drivers in country areas"<sup>9</sup>.*

Clearly this example can be translated to the New Zealand context, as the level of congestion which is tolerated in Auckland is significantly higher than elsewhere.

### Targets in New Zealand

In order to assist the preparation of this paper, I have researched the targets around New Zealand.

I am aware of no guidance on target levels of service in Auckland. The Regional Land Transport Strategy includes targets related to congestion, but these are based on alternative measures, such as reducing the variability in speeds on the motorways and major arterials and percentage changes in speeds to key locations, such as the port and airport, and between key business centres<sup>10</sup>.

Auckland Regional Transport Authority's (ARTA) Guidelines for Integrated Transport Assessments do not refer to this issue and it is implicitly assumed that it should be a topic for discussion at the Scoping Stage. I am advised that for passenger transport, ARTA consider that reliability, frequency of service and separation from congestion are far more important level of service criteria than speed.

Queenstown Lakes District Council's "Futurelink" document states that the minimum level of service in Queenstown should generally be D, but that E may be experienced during peaks (for short periods and not creating recurrent congestion)<sup>11</sup>.

Tauranga City Council aims for a level of service E for local roads at peak times. It also requires the "Smart Transport Corridors" to provide a better level of service than local roads, although it does not suggest a specific value<sup>12</sup>.

I am not aware of any specific level of service targets within the Wellington region. The Regional Land Transport Strategy aims to keep average congestion on selected roads below 20 seconds delay per kilometre<sup>13</sup>, but this

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<sup>8</sup> HCM (2000), page 2-3.

<sup>9</sup> RTA Guide (2002), page 4-3

<sup>10</sup> Auckland Regional Land Transport Strategy, pages 107-108

<sup>11</sup> Queenstown "Futurelink" document, (2005) page 19

<sup>12</sup> Tauranga City Council: Integrated Transport Strategy.

<sup>13</sup> Wellington Regional Land Transport Strategy (2007), page 26

cannot be directly translated into a particular level of service without knowing the free flow speed on these selected roads.

Level of service targets are set out in the Canterbury Regional Land Transport Strategy. These targets are summarised at Table 3 below.

Table 3: Level of Service Targets in Canterbury<sup>14</sup>

Road Type	Peak Times	Other Times
Strategic urban road network outside and including the Christchurch ring road	D	C
Remaining classified road network (except as stated below)	C	B
Christchurch CBD (inside the four avenues)	Though not desirable, LoS F is accepted	E
Remainder of the Christchurch classified road network	E	D

This list gives a mix of regional and local targets and it is not exhaustive. Also, I have not referred to informal rules of thumb which are used by many local authority officers.

## DISCUSSION

The recent update to the New Zealand Transport Strategy (NZTS) and the accompanying Government Policy Statement (GPS) emphasise the need for a greater focus on the management of travel demand and they include targets for increased passenger transport and walking and cycling and reduced kilometres travelled by single occupant vehicles. This would appear to give greater impetus to the statements in various regional land transport strategies which emphasise that we can no longer follow a "predict and provide" approach for general traffic demands. This implicitly suggests that congestion (and therefore a poor level of service) may be acceptable. Also, I am aware that congestion is increasingly seen as being complementary to travel demand management (TDM) strategies which are seeking to establish greater emphasis on modes of transport other than single occupant private vehicles, as long as that congestion does not adversely affect the priority modes.

On the other hand, the NZTS and GPS also refer to the need to improve reliability of travel times. A critical issue is therefore the statement in the NZTS that an appropriate balance is needed between the management of travel demand and the level of supply to meet demand and maintain levels of service<sup>15</sup>.

I suggest that levels of service guidelines need to be developed which reflect the following:

- ◆ The need to ensure that the level of operation of the road network is consistent with expectations for that area;
- ◆ The need to ensure that the strategic road network can continue to fulfil its intended role;
- ◆ The need to ensure that priority users (especially buses and freight movements) are not unduly held up by congestion.

This issue needs to be fed across to the transport assessments of the effects of new developments. Traditionally assessments of the suitability of the development have concentrated on maintaining the level of service that is predicted for the scenario without the development and this often leads to road network improvements to mitigate the effects of development, such as an intersection upgrade. This form of assessment may no longer be sufficient and adverse effects on the road network may be acceptable in a number of situations, such as:

<sup>14</sup> Canterbury Regional Land Transport Strategy (2005), Appendix 4

<sup>15</sup> New Zealand Transport Strategy (2008), page 30

- ◆ If the development is consistent with the approved growth strategy;
- ◆ If the development is well served by passenger transport, walking and cycling and to mitigate the predicted adverse traffic effects would have unacceptable consequences (for example adverse effects on urban design);
- ◆ If it can be demonstrated that the development is consistent with the aim to reduce the overall demand for travel (for example by reducing kilometres travelled), despite possible local congestion "hotspots".

Clearly the above can only be assessed on a site by site basis.

## CONCLUSIONS

The conclusions of this paper are:

- ◆ The current definitions of level of service F are too narrowly defined.
- ◆ A new term should be introduced which could be called level of service F-, F+ or G. At this stage I suggest that this category could relate to delays of over 3 minutes or degrees of saturation of more than 110% on approaches to intersections, and to average speeds below certain thresholds for each road type.
- ◆ It could be that more than one new category could be introduced. However I suggest that traffic models tend to struggle where conditions are very congested, to the extent that results are often unstable and therefore of limited reliability. This will limit the usefulness of more than one additional category.
- ◆ I accept that the full implications of introducing an additional level of service category need to be carefully considered. It could be that the additional category may unwittingly increase the perceived acceptability of other categories. For example, a level of service F would no longer be "as bad as it gets".
- ◆ The concept of level of service targets may appear to be attractive, but conditions are too specific to each locality for a single target to be meaningful, even a single target for each region. Local guidelines would probably be useful, but these would need to be worded carefully to allow sufficient discretion.

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