Example: Task 2.4 Generalised Cost - Decisions

These generalised costs apply to the mode choice and distribution modelling. For assignment, routeing parameters representing current best practice in NZ will be tuned to best reproduce observed routeing patterns. In the public transport assignment, this may imply different weights on bus and rail in-vehicle time which would be carried forward into the other models.

Values of Time

The values of time adopted are the latest values used in economic appraisal, the resource values for non-business trips being increased by sales tax to give market values.

The model requires average values for persons of a particular segment: trip purpose and a further segmentation by captive and choice. These values can vary by mode in the model, but only if this reflects some perceived comfort difference. Because the differences in the economic appraisal values also encompass differences between the types of people using each mode, they cannot necessarily be used directly in the model. We need also to consider crowding, reliability and congestion effects.

The following assumptions were used in deriving the Wellington model values of time:
❑ for each purpose and segment, the values of time are an average of the car and van/ute driver, car and van/ute passenger and public transport values of time, the average being based on current mode shares; walk and cycle trips have been ignored because they are short distance essentially local/intrazonal;
❑ the public transport values of time used in the averaging assume 10% standing passengers for HBW trips (which all occur in the peaks);
❑ congestion and reliability values of time for cars are not included – while they have been established for evaluation purposes, there are no immediate proposals for including them in behavioural modelling (or assignment);
❑ we have combined home based shopping, social, other and non home based other trips which have similar values of time.

Vehicle Driver and Passenger Generalised Cost Attributes

The generalised cost attributes are time, operating cost, parking charges and tolls:
❑ the three cost items will be divided by the values of time;
❑ operating costs:
  – for non-work travel will refer only to fuel cost including sales tax;
  – for business car and commercial vehicle (CV) trips, the full operating costs will be used (with sales tax assumed to be refunded and therefore excluded);
❑ the parking charges attributable to a trip will be factored by 0.5, as these charges are shared between the in and out-bound trips;
❑ passenger/driver: the approach used in the London model is to divide costs by average car occupancy so that the cost represents the average cost per person and is directly comparable with public transport fares; we prefer this approach.

The formula is thus:

Gen cost = in-vehicle time + (parking cost/2 + operating cost + toll)/(VoT* occupancy)

Public Transport Passenger Generalised Cost Attributes

The generalised cost parameters are in-vehicle time, other time (access, egress & walking times), interchange, waiting time at boarding and interchange, and fare:

❑ the fare will be divided by the values of time;
❑ other time will be weighted by 2.0 (given that we have gone to some lengths to get the times on centroid connectors reasonable, we can weight them by 2 without fear of introducing bias or major error).

Based on existing practice in NZ, we shall use interchange penalties of:

❑ 10 minutes for standard interchanges,
❑ 8 minutes for purpose-built interchanges, and
❑ 5 minutes for high quality and/or planned interchanges.

A review of waiting time factors is given in the tables below, the first giving the disutility of waiting time and the second the benefits of improving waiting time (indirectly a measure of the sensitivity of the model to headway differences). Table 1 compares various formulae for the disutility of public transport headway:

▢ 'standard' in which waiting time is half the headway and is multiplied by a cost factor of 2.0;
▢ UKR are disutilities derived from UK rail passenger demand forecasting practice;
▢ Wardman draws on a review by ITS Leeds;
▢ BAH is a formula used by Booz Allen & Hamilton;
▢ APT is a formula used in the Auckland public transport model (in EMME/2);
▢ PEM is the that most recently recommended in the NZ Project Evaluation Manual;
▢ WTSM is what is recommended for the Wellington Model = $2*(1.5+0.25*headway)$.

EMME/2 is constrained in the waiting time functions that can be accepted to a linear formula of a boarding penalty (of 1.5 mins) and a factor on headways (of 0.25).

The generalised cost formula is thus:

Gen cost = in-vehicle time + I*interchange penalty +2*(access and egress time) + $\Sigma_s 2*(1.5+0.25* headway_s) + fare/VoT$

Where:
I number of interchanges
s is services boarded
Note that walk, car and bus access and egress are not distinguished. An average access time as a function of access/egress distance is calculated based on the mix of modes used by rail passengers for each distance. These times are weighted by 2.

Table 1 The Disutility (mins) of Headway

Headway (mins)	Standard	UKR	Wardman	BAH	APT	PEM	WTSM
5	5	5	3	5	8	5	6
10	10	10	6	8	10	7	8
20	20	19	12	14	15	10	13
30	30	25	17	18	19	14	18
40	40	29	22	23	24	18	23
50	50	33	27	27	28	21	28
60	60	36	32	31	32	24	33

Walk/Cycle Time

When walk/cycle is the main mode, this will be weighted in the model as 1.0 (but this can be changed if it poses modelling difficulties).