Valuing freight transport time and reliability - user benefits

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Scope and Issues

- Part of NZTA research programme:
  
  "Valuing time and reliability for freight transport beyond the allocation of marginal vehicle and driver utilisation costs"

- EEM compares scheme user benefits with relevant (capex/opex) costs, eg for PT user benefits:
  - In vehicle time, waiting time, access/egress time, transfer time
  - Travel time reliability
  - Station/stop quality; vehicle quality and comfort

- But for freight, current EEM largely omits potential benefits to NZ shippers of roading schemes:
  - This study aims to plug this gap

- Potential freight shipper benefits include:
  - Time value of early/late receipt of freight (including stockholding costs)
  - Travel time reliability (reduced variability)
  - Service frequency
  - Loss/damage to freight

- Covers NZ freight market:
  - Not international transport, but includes domestic legs
  - Road/rail principally, some coverage of coastal shipping
  - Modally neutral
  - Focus on heavy freight movements
  - Excludes transport operator costs.
NZ Land Freight Transport Task

Net Tonne Km by Mode and Commodity Group (NFDS 2014)

1: Retail, manufacturing, general
(commodity value $3600/t)

2: Perishable exports
($2800/t)

3: Other containerised exports
($700/t)

4: Bulk exports
($300/t)

5: Other domestic
($300/t)
Market survey overview

• Original intention (project proposal stage)
  o **Not** to do a major survey -- use values from Kim PhD for commodity group 1; ‘triangulate’ with international literature for other commodity groups
  o Found this would not give adequate set of values for whole of NZ freight sector – no independent check on Kim’s results; international literature inadequate (very wide range of results); structure of NZ economy very different from most other developed countries.

• Modified approach adopted
  o Personal interview survey of NZ freight shippers, covering large proportion of heavy freight movements
  o Contingent valuation’ approach – shipper willingness-to-pay for enhancements to current freight travel time, reliability, service frequency and other factors
  o 59 interviews (143 market segments) covered c 23% of NFDS total tonnage, 34% of total tonne km.

• Extensive data set on NZ freight sector and traffics
  o Company data – size, turnover, employees, etc
  o Commodity segment = commodity group by one of 3 O-D groups, ie within a region, inter-regional, inter-island.
  o Data on tonnage, O-D, trip length and time, commodity value, transport price
  o Modal data – chosen mode(s), alternative modes available, reasons for preferred mode, carrier preference factors
  o Service factors – importance of price, fast journey time, reliable journey time, frequency, freight loss/damage
  o Willingness to pay (maximum) for enhanced service.
Selected freight characteristics (1)

Freight task by O-D category

- Local traffic 62% t, only 22% tkm (ave haul 57km)
- Interregional 35% t, 63% tkm (ave haul 290km)
- Interisland 2% t, 14% tkm (ave haul 1245km)

Freight task by mode by haul distance

- Market shares by mode show a strong pattern of variation with haul distance
- Local movements (<100 km) - road c80% of total
- Inter-regional movements (500-1000 km) - road/rail c70%
- Longer distances (mostly inter-island), ship only and road/rail/ship dominant
Selected freight characteristics (2)

Transport price per tonne vs distance
- For given distance, prices per tonne are
  - Lower than average for commodity groups 2 (e.g. raw milk, fish), 3 (e.g. logs) and 4 (steel, coal)
  - Higher than average for groups 1 (retail, manufacturing) and 5 (e.g. liquid fuels)

Road preference factors by O-D category
- For traffic that could change from road haul:
  - Local hauls - cost dominant factor
  - Interregional hauls - cost, time, door-door, reliability, frequency similar importance
  - Interisland - reliability and time dominant

Transport price per tonne vs haul length by commodity group - log scales

Road preference reasons by OD group (n=114)
Willingness-to-pay questions

Time

• What is your actual (expected) journey time, and is it fixed?

• Where a potential trade-off between price and expected journey time, what is:
  
  (a) the **maximum extra price** willing-to-pay (“WTP”) in return for a shorter journey time (10%/25%/50% shorter)?
  
  (b) the **minimum price discount** willing-to-accept (“WTA”) in compensation for a longer journey time (10%/25%/50% longer)?

Note: WTA low response and interpretation problems -- not dealt with in this presentation

Reliability

• Is variability in travel time enough to cause concern; if yes, what % of journeys affected and their average lateness?

• Where a potential trade-off between price and reliability, what is:
  
  (a) the **maximum extra price** willing-to-pay in return for a more reliable journey (late 25%/50%/100% less often):
  
  (b) the **minimum price discount** willing-to-accept in compensation for a less reliable journey (late 25%/50%/ 100% more often)?
WTP time & reliability - results

- Value units: per (net) tonne; TT per 1 hr reduction in expected TT; reliability per 1 hr reduction in TT SD
- **Expected TT.** Over all survey respondents, time savings worth average $0.45/hour
- Time savings valued much higher by group 1 (ave $1.13/hr) - over 4 times value for other groups
- **TT reliability.** Few respondents with a reliability trade-off, but some high values; overall average $2.52/hr SD
- Reliability valued much higher by group 1 (ave $8.95/hr SD) – about 16 times value for other groups.

<table>
<thead>
<tr>
<th>Willingness to pay: time</th>
<th>Respondents with trade-off</th>
<th>All survey respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S/t/hr</td>
<td>$/t/hr</td>
</tr>
<tr>
<td>Group 1</td>
<td>$10.98</td>
<td>$1.13</td>
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<tr>
<td>Groups 2-5</td>
<td>$3.45</td>
<td>$0.26</td>
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<td>All groups average</td>
<td>$5.45</td>
<td>$0.45</td>
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</table>

<table>
<thead>
<tr>
<th>Willingness to pay: reliability</th>
<th>$/t/SD hr</th>
<th>$/t/SD hr</th>
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<tbody>
<tr>
<td>Group 1</td>
<td>$28.44</td>
<td>$8.95</td>
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<tr>
<td>Groups 2-5</td>
<td>$27.96</td>
<td>$0.57</td>
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<tr>
<td>All groups average</td>
<td>$28.33</td>
<td>$2.52</td>
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</table>
# New time and reliability values for EEM

<table>
<thead>
<tr>
<th>Commodity Gp</th>
<th>This study results</th>
<th>Recommended new EEM values</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>HCV 44t gross (HCV II)</td>
<td>HCV 50 t gross</td>
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<tr>
<td></td>
<td>Time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Per tonne per hour</td>
<td>Per truck per hour</td>
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<tr>
<td>Group 1</td>
<td>$1.13</td>
<td>$19.66</td>
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<td>Groups 2-5</td>
<td>$0.26</td>
<td>$3.86</td>
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<td>All groups ave</td>
<td>$0.45</td>
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<tr>
<td></td>
<td>Reliability</td>
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<td></td>
<td>Per tonne per hour SD</td>
<td>Per truck per hour SD</td>
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<tr>
<td>Group 1</td>
<td>$8.95</td>
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<tr>
<td>Groups 2-5</td>
<td>$0.57</td>
<td>$7.52</td>
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<tr>
<td>All groups ave</td>
<td>$2.52</td>
<td>$42.18</td>
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</tbody>
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- Values in $2017 (for $2002, as per EEM, divide by 1.47).
- Values in tonnes can be extrapolated to HCV I, MCV, LCV (or any other size of truck)
- **Time values.** Group 1 time values consistent with Kim’s NZ PhD values
- Time values replace current EEM value (stockholding value, $3.18/truck/hr in $2017)
- **Reliability values.** Reliability apparent high values but per 1-hr change in SD of travel time
- New benefit in EEM, currently no value for reliability from shipper viewpoint.
Frequency, loss/damage, other issues

• Similar WTP questions covered service frequency and loss/damage – great majority had no/minimal willingness-to-pay for improvements

• 87% thought service frequency was an important/very important factor in choosing a carrier
  o But only 4 respondents willing to pay more for better frequency
  o Indicates general satisfaction with existing frequencies

• Loss/damage not seen as substantial issue, good standard already

• General comments from respondents:
  o Network resilience important as well as reliability
  o Safety management important in choosing carrier
  o Congestion big issue (not just AKL region)
  o Potential for greater use of rail – but dependent on reliability and availability enhancements
Conclusions

• VoT estimates derived very consistent with Kim’s NZ PhD figures (group 1)
  o also within the (wide) range of values from the international literature
  o shipper VoT substantially higher than current EEM shipper values for travel time

• Very limited comparisons possible for VoR estimates
  o not able to compare with Kim’s figures; great range of international values
  o reliability highly valued by a significant proportion of shippers (esp group 1)

• Survey approach appears to give reliable and robust results
  o contingent valuation methodology with personal interviews appears successful
  o arguably more realistic results and less costly than ‘full’ multi-variate SP.

• Resultant VoT, VoR values appropriate for direct inclusion in EEM
  o for project evaluation, may apply to freight traffic volumes in aggregate
  o or may distinguish group 1 and groups 2-5 if data available (eg. where more retail and manufacturing in mix than average, such as the Auckland region)

• Up with world’s best practice for valuation of freight shipper benefits???
  o waiting on verdicts of peer reviewers!!!