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Inter-Modal Diversion Factors: Review of Evidence

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SYSTRA

THE STUDY

- UK Department for Transport has official (WebTAG) guidance for diversion factors from rail to car
- Recognised lot of other evidence available
- Existing recommendations dated
- Interest in ‘slow modes’
- Jointly undertaken by RAND Europe and SYSTRA

WHAT IS A DIVERSION FACTOR?

- It denotes movement (diverting) between travel options after a change in some feature of a travel option
- It can indicate switching between, say, modes, routes, tickets, operators, destinations ……..

- We are here interested in inter-modal diversion factors:
  - If Mode X gets worse, what do those who switch out of it do?
  - If Mode X gets better, where do those attracted to it come from?

IMPORTANCE OF DIVERSION FACTORS

- They indicate source of new traffic/destination of lost traffic which is important in appraisal
- Cross elasticities are important in appraisal and forecasting. But obtaining robust estimates can be hampered because:
  - Generally small
  - Little variation/No historic data
  - Reliance on SP
- Moreover they are intrinsically more variable.
- They can be (locally) deduced from using diversion factors as:

$$e_{ij} = \left|e_{jj}\right| \frac{V_j}{V_i} \delta_{ji}$$

‘CONVENTIONAL’ (UK) WISDOM

- Demand for Public Transport ‘White Book’ TRL et al. 2004
  - Update of TRRL 1980 ‘Black Book’
- UK Department for Transport Official WebTAG values
- GB Rail Industry Passenger Demand Forecasting Handbook (PDFH)
  - Diversion Factors between Modes (from other modes to rail)
  - Diversion Factors between Tickets (to model ticket competition)

DEMAND FOR PUBLIC TRANSPORT 'WHITE BOOK' TRL ET AL. (2004)

	DIVERSION FACTORS: TRL ET AL. (2004) 'WHITE BOOK'				
	Urban				
Mode To/from	Bus	Car	Rail	Cycle/Walk	Generated
Bus		0.31	0.06	0.42	0.21
Car	0.48		0.24	0.06	0.22
Rail	0.41	0.33		0.01	0.24
	Interurban				
	Coach	Car	Rail	Air	Generated
Coach		0.22	0.60		0.18
Car	0.10		0.42	0.01	0.47
Rail	0.20	0.60		0.06	0.14

UK DEPARTMENT FOR TRANSPORT WEBTAG GUIDANCE

- Update Diversion Factors from Rail to Car published in July 2017
  - London Travelcard Area 22%
  - South East to London 21%
  - To London: 20-100 miles 24%, 100-200 miles 26%, 200+ miles 25%
  - Non London Long 30%
  - Non London Short 27%
- National Transport Model
  - Rail to Bus 16%
  - Rail to Car Driver 44%
  - Rail to Car Passenger 24%
  - Rail to Cycle 4%
  - Rail to Walk 12%
  - But no diversion to not travel!

PASSENGER DEMAND FORECASTING HANDBOOK

- PDFH version 5.1 (2013) Modal Diversion Factors:

	Commuting		Business		Leisure	
`	Urban	Interurban	Urban	Interurban	Urban	Interurban
Car to Rail	31%	62%	32%	43%	15%	42%
Bus to Rail	41%	-	-	-	41%	60%

- PDFH version 6.0 (Early 2018) will adopt the Diversion Factors of this Review

NEED FOR REVIEW

- Why was a Review Needed?
  - Little evidence in official recommendations
  - Dated evidence
  - Lack of detail/segmentation
  - DfT interest in evaluating ‘slow mode’ schemes
  - General greater interest in competition between modes
  - Recognition that there is a lot of evidence

DATA ASSEMBLY: INFORMATION RECORDED

- study identification information - authors, publication date
- publication type
- study location/country
- sample size, time period of data collection
- intervention (e.g. new infrastructure, price/service change, policy/regulatory change)
- data type (e.g. observed data, best alternative, transfer price)
- choice set of available travel options
- diversion factors by:
  - mode and form of diversion factor
  - other possible segmentations (trip purpose, journey type, passenger type, area)
  - other segmentations of interest (income, gender, time of day)

MAIN CHARACTERISTICS OF DIVERSION FACTOR DATASET

Characteristic	Summary
No of diversion factor values	1009 values from 45 studies
Publication date	1982 – 2017, with over 60% of data in studies published 2010 or later
Publication type	20% of data journals, 35% published reports and 30% unpublished reports
Location of study	85% of data from UK
Study design	Around 30% of data from observed change, 30% from reported best alternative, more than 35% from Transfer Price
Intervention	45% of diversions were due to improvement or deterioration in service and 20% to new infrastructure.
No of modes	23 (including non-travel options)
No of Choice sets	50
Journey type	55% of data were for urban journey, 34% for interurban
Area type	42% of data for metropolitan areas, only 3% for small towns and rural
Trip purpose	Data were collected for 14 trip purposes. 18% of data were commute, 13% business travel and 28% from leisure trips. For 30% of trips, no distinction by trip purpose was recorded.
Passenger type	Only 13 values were for concessionary travellers.
Other segmentations	There was little or no diversion factor data by income, gender, car availability or time of day (except commute).

DIVERSION FACTORS FROM CAR

CAR	Bus	Rail	LR	Cycle	Walk	Taxi	Not Travel	Other
Commute	0.23	0.06	0.06	0.13	0.10	0.11	0.17	0.14
Leisure	0.21	0.07	0.08	0.03	0.13	0.17	0.20	0.10
Observed	0.15	0.27						
Best Alternative	0.18	0.46	0.23	0.05	0.09	0.08	0.17	0.14
Urban <10km	0.29	0.03	0.04	0.11	0.16	0.13	0.15	0.10
Urban >10km	0.15	0.11	0.12	0.06	0.03	0.15	0.24	0.14

DIVERSION FACTORS FROM BUS

BUS	Car	Rail	LR	Cycle	Walk	Taxi	Not Travel	Other
Commute	0.44	0.35	0.29	0.08	0.16	0.08	0.14	0.12
Leisure	0.26	0.38	0.58	0.02	0.52	0.10	0.04	0.13
Observed	0.30			0.02	0.15		0.31	0.15
Best Alternative	0.29	0.36	0.19	0.07	0.22	0.12	0.11	0.12
Car Available	0.75	0.03	0.03	0.02	0.06	0.06	0.04	0.02
No Car Available		0.13	0.11	0.07	0.17	0.23	0.18	0.11
Urban <10km	0.34	0.07	0.07	0.04	0.15	0.17	0.10	0.05
Urban >10km	0.32	0.12	0.09	0.05	0.04	0.10	0.11	0.12

DIVERSION FACTORS FROM TRAIN

RAIL	Bus	Car	LR	Cycle	Walk	Taxi	Not Travel	Other
All	0.22	0.34	0.09	0.04	0.01	0.04	0.17	0.38
Observed	0.25	0.31					0.25	0.52
Best Alternative	0.23	0.43	0.08	0.05	0.02	0.05	0.16	0.18
Car Available	0.05	0.84	0.05	0.01	0.00	0.02	0.01	0.05
No Car Available	0.36		0.17	0.02	0.03	0.14	0.21	0.36
Urban <10km	0.23	0.46	0.09	0.03	0.01	0.05	0.09	0.23
Urban >10km	0.15	0.50	0.11	0.01	0.01	0.07	0.10	0.15

OVERALL RECOMMENDATIONS

Intervention mode	Recipient/source mode						
	Bus	Car	Rail	Light rail / metro	Cycle	Walk	Generated traffic (no travel)
Bus		All trip purposes: 0.20-0.35 Commute: 0.30-0.55	Urban areas: 0.05-0.2 Intercity: 0.45-0.65	Urban areas: 0.05-0.35	Urban areas: 0.04-0.08	Urban areas: 0.1-0.3	Urban areas: 0.10-0.20 Interurban: 0.07-0.11
Car	Urban areas: 0.20-0.40 Interurban: 0.07-0.11		Urban areas: 0.05-0.20 Interurban: 0.55-0.75	Urban areas: 0.10-0.35	Urban areas: <0.1	Urban areas: 0.05-0.15	Urban areas: 0.1-0.25 Interurban: 0.10 - 0.25
Rail	Urban areas: 0.25-0.4 Interurban: 0.1-0.2	Urban areas: 0.3-0.45 Interurban: 0.4-0.55		Urban areas: 0.05-0.15	Urban areas: <0.1	Urban areas: <0.05	Urban areas: 0.10-0.20 Interurban: 0.10-0.20
Light rail / metro	Urban areas: 0.25-0.4	Urban areas: 0.15-0.3	Urban areas: 0.15-0.3		Urban areas: < 0.1	Urban areas: < 0.05	Urban areas: 0.10-0.20

RECENT APPLICATION: DEDUCED FUEL CROSS-ELASTICITIES

FLOW TYPE		PURPOSE	SAMPLE	CAR %	RAIL %	RATIO (C/R)	DFT ELAS	META ELAS	DIVERSION	DFT CROSS	META CROSS	MEAN
Long distance to/from London (<150miles)	Central London	Business	277	0.18	0.82	0.21	-0.1	-0.21	0.65	0.01	0.03	0.02
	Central London	Leisure	318	0.19	0.81	0.24	-0.4	-0.41	0.65	0.06	0.06	0.06
Long distance to/from London (>150 miles)	Central London	Business	86	0.15	0.85	0.18	-0.1	-0.21	0.65	0.01	0.02	0.02
	Central London	Leisure	111	0.10	0.90	0.11	-0.4	-0.41	0.65	0.03	0.03	0.03
Long distance to/from London overall	Central London	Business	363	0.17	0.83	0.21	-0.1	-0.21	0.65	0.01	0.03	0.02
	Central & Inner London	Business	690	0.21	0.79	0.27	-0.1	-0.21	0.65	0.02	0.04	0.03
	Greater London	Business	914	0.36	0.64	0.56	-0.1	-0.21	0.65	0.04	0.08	0.06
	Central London	Leisure	429	0.17	0.83	0.20	-0.4	-0.41	0.65	0.05	0.05	0.05
	Central & Inner London	Leisure	1101	0.29	0.71	0.41	-0.4	-0.41	0.65	0.11	0.11	0.11
	Greater London	Leisure	1784	0.49	0.51	0.95	-0.4	-0.41	0.65	0.25	0.25	0.25
Non London long < 100 miles		Business	373	0.91	0.09	9.97	-0.1	-0.21	0.65	0.65	1.36	1.00
		Leisure	908	0.71	0.29	2.44	-0.4	-0.41	0.65	0.63	0.65	0.64
Non London long > 100 miles		Business	91	0.79	0.21	3.79	-0.1	-0.21	0.65	0.25	0.52	0.38
		Leisure	97	0.58	0.42	1.37	-0.4	-0.41	0.65	0.36	0.36	0.36
Overall Non London		Business	464	0.89	0.11	7.75	-0.1	-0.21	0.65	0.50	1.06	0.78
		Leisure	1005	0.70	0.30	2.30	-0.4	-0.41	0.65	0.60	0.61	0.60
London Travel Card Area		Commute	10010	0.48	0.52	0.92	-0.3	-0.21	0.12	0.03	0.02	0.03
		Business	1862	0.62	0.38	1.63	-0.1	-0.12	0.12	0.02	0.02	0.02
		Leisure	11003	0.72	0.28	2.62	-0.4	-0.23	0.12	0.13	0.07	0.10
South East to London	Central London	Commute	1117	0.04	0.96	0.04	-0.3	-0.36	0.65	0.01	0.01	0.01
	Central & Inner London	Commute	1836	0.14	0.86	0.16	-0.3	-0.36	0.65	0.03	0.04	0.04
South East to/from London	Central London	Business	537	0.22	0.78	0.28	-0.1	-0.21	0.65	0.02	0.04	0.03
	Central & Inner London	Business	952	0.35	0.65	0.53	-0.1	-0.21	0.65	0.03	0.07	0.05
	Central London	Leisure	1024	0.14	0.86	0.16	-0.4	-0.41	0.65	0.04	0.04	0.04
	Central & Inner London	Leisure	2538	0.32	0.68	0.47	-0.4	-0.41	0.65	0.12	0.12	0.12
Non London <20 miles	Within Urban Areas	Commute	521	0.82	0.18	4.66	-0.3	-0.21	0.12	0.17	0.12	0.14
		Business	90	0.90	0.10	9.00	-0.1	-0.12	0.12	0.11	0.13	0.12
		Leisure	802	0.91	0.09	9.99	-0.4	-0.23	0.12	0.48	0.28	0.38
Non London (21-50 Miles)	Between Met Areas	Commute	2162	0.86	0.14	5.97	-0.3	-0.21	0.12	0.22	0.15	0.18

SYSTRA

FUTURE RESEARCH PRIORITIES

- Review provides much new and useful evidence, BUT
- Evidence is diverse
- Need systematic understanding of key influences such as journey purpose, attractiveness of other alternatives, distance,