Giving cycling the green light
An overview of transportation safety in Ireland and the design of the National Cycle Network
Outline

Part One: Background to Irish Transportation

Part Two: Irish National Cycle Network & Research at NUI Galway
Ireland

- Western Europe
- Member of EU (since 1973)
- Land border with UK
- Approx. 250 km x 500 km (closest in size to Maine)
- Population: 4.6 million (2011)
- Commuters: 1.7 million (2011)

CSO (2012). This is Ireland: highlights from Census 2011
Commuting in 2011

- On foot: 8%
- Bicycle: 4%
- Bus, minibus or coach: 2%
- Train, DART or LUAS: 1%
- Motor cycle or scooter: 1%
- Motor car: Driver: 5%
- Motor car: Passenger: 3%
- Other (van etc.): 1%
Commuting in 2011

Car driver: 65%

Van driver: 8%

Passenger: 4%
60% DOGS (LIKE HUMANS) ARE OVERWEIGHT OR OBESE
Commuting across a generation
(2011 modal share)

- On foot (10%)
- Train, DART or LUAS (3%)
- Motor car: Passenger (4%)
- Bicycle (2%)
- Motor cycle or scooter (1%)
- Bus, minibus or coach (6%)
- Motor car: Driver (65%)
- Other (8%)

CSO (2012). This is Ireland: highlights from Census 2011
Commuting across a generation
(2011 modal share)

CSO (2012). *This is Ireland: highlights from Census 2011*
Commuting across a generation

Walking modal share (%)

CSO (2012). This is Ireland: highlights from Census 2011
Commuting across a generation

Cycling modal share (%)

CSO (2012). *This is Ireland: highlights from Census 2011*
Travel to Primary School
(4-12 years old)

CSO (2012). This is Ireland: highlights from Census 2011
Travel to Secondary School (13-18 years old)

On foot: 12%
Bicycle: 16%
Bus, minibus or coach: 40%
Train, DART or LUAS: 2%
Motor cycle or scooter: 2%
Motor car: Passenger: 2%
Motor car: Driver: 2%
Other means (incl. Lorry or van): 2%

CSO (2012). This is Ireland: highlights from Census 2011
Travel to Higher Education

CSO (2012). *This is Ireland: highlights from Census 2011*
Travel to Higher Education

CSO (2012). *This is Ireland: highlights from Census 2011*
Disappearing rail network

Hennessy (2012). *An animated timeline map of Irish railways*
Derived demand - spatial mismatch

Employment

Residence

Morgenroth (2009). *Commuting Trends: Implications of Structural Economic Change*
Average distance travelled to work (km)

Based on EPA (2011). *Ireland’s greenhouse gas emissions in 2011*
Some Positives

- Policy: Smarter Travel, Cycle Policy, Urban Streets
- National Cycling Network (next part)
- Dublin Bikes share scheme (to be extended)
- Smarter Travel areas (Westport, Limerick etc.)
- Rail use doubled in 30 years (DART & Luas)
- Road safety improvements
Road Safety

• Some good news!

• Irish roads now amongst safest in the world

• Fatalities down from 640 to 162 in 40 years

• Pedestrian and cyclist fatalities down 66%

• Must consider health, environmental, social and economic effects of driving
Fatalities

Fatalities per million population

Need data per km travelled

Fatalities per million population

USA (104)
California (73)
Ireland (41)

NHTSA (2013). Fatality analysis reporting system
Fatalities by mode

Serious Injuries

Part Two

Irish National Cycle Network & Research at NUI Galway
National Cycling Network

13 corridors (≈ 2200 km in total)

Rural / Inter-urban basis

User groups:
1. Commuters
2. Cycle tourists
3. Leisure cyclists

Significant amount of cycling infrastructure planned in the coming years

NRA (2010). National Cycle Network Scoping Study
EuroVelo

12 long distance routes over 66,000 km (45,000 km complete)

2 routes through Ireland: ‘Atlantic Route’ & ‘Capitals Route’

Importance for cycle tourism

ECF (2013). EuroVelo Routes
Multi-criteria analysis

- Evaluation of transport projects
- Cost-Benefit Analysis most common evaluation
- Not realistic to assign monetary values to all criteria
- MCA considers combination of monetary and non-monetary impacts
- Performance Matrix / Consequence Table
- Need criteria
- Need scores
- Need weightings

Example: buying a toaster

### Table 4.1 Performance matrix

<table>
<thead>
<tr>
<th>Options</th>
<th>Price</th>
<th>Reheat setting</th>
<th>Warming rack</th>
<th>Adjustable slot width</th>
<th>Evenness of toasting</th>
<th>Number of drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boots 2-slice</td>
<td>£18</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>☆</td>
<td>3</td>
</tr>
<tr>
<td>Kenwood TT350</td>
<td>£27</td>
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<td>✔️</td>
<td></td>
<td>☆</td>
<td>3</td>
</tr>
<tr>
<td>Marks &amp; Spencer 2235</td>
<td>£25</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td>★</td>
<td>3</td>
</tr>
<tr>
<td>Morphy Richards Coolstyle</td>
<td>£22</td>
<td>✔️</td>
<td></td>
<td></td>
<td>★</td>
<td>2</td>
</tr>
<tr>
<td>Philips HD4807</td>
<td>£22</td>
<td></td>
<td></td>
<td></td>
<td>★</td>
<td>2</td>
</tr>
<tr>
<td>Kenwood TT825</td>
<td>£30</td>
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<td></td>
<td></td>
<td>★</td>
<td>2</td>
</tr>
<tr>
<td>Tefal Thick’n’Thin 8780</td>
<td>£20</td>
<td>✔️</td>
<td></td>
<td></td>
<td>★</td>
<td>5</td>
</tr>
</tbody>
</table>

### Table 6.4 Calculating overall scores

<table>
<thead>
<tr>
<th>Options</th>
<th>Price</th>
<th>Reheat setting</th>
<th>Warming rack</th>
<th>Adjustable slot width</th>
<th>Evenness of toasting</th>
<th>Drawbacks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boots 2-slice</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>Kenwood TT350</td>
<td>25</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>80</td>
<td>61</td>
</tr>
<tr>
<td>Marks &amp; Spencer 2235</td>
<td>42</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>50</td>
<td>53</td>
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<td>Morphy Richards Coolstyle</td>
<td>67</td>
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<td>100</td>
<td>0</td>
<td>100</td>
<td>50</td>
<td>53</td>
</tr>
<tr>
<td>Philips HD4807</td>
<td>67</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>90</td>
<td>49</td>
</tr>
<tr>
<td>Kenwood TT825</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>Tefal Thick’n’Thin 8780</td>
<td>84</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>70</td>
</tr>
</tbody>
</table>

Weights:

- Price: 30
- Reheat setting: 5
- Warming rack: 15
- Adjustable slot width: 25
- Evenness of toasting: 15
- Number of drawbacks: 10

Multi-criteria analysis for the route selection of greenways

- Environment
- Economy
- Safety
- Design
- Connectivity
- Integration
Adapting MCA for route selection

(Route) Options: determine from nature, infrastructure, policy, public consultation etc.

Criteria: literature review, surveys

Scores: this research

Weights: this research

Determine a preferred route and analyse

Test against case studies, role of public consultation

Great Western Greenway
Co. Mayo

Achill Tourism (2013)
What went before:

UK Dept. for Transport
Irish National Roads Authority
Research at Trinity College Dublin

Mayo CoCo (2010)
A modal shift to cycling would reduce carbon emissions due to transport.

A significant infrastructure required to encourage such a shift.

Environmental impact of cycle route construction not previously considered.

‘carbon costs’ of these routes may negate any ‘carbon savings’.

Creating a balance sheet for the carbon costs and savings.
Using the Great Western Greenway as a case study...

<table>
<thead>
<tr>
<th>Carbon footprint of a greenway (kgCO₂e/km)</th>
<th>58836</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of the greenway (km)</td>
<td>10</td>
</tr>
<tr>
<td>Avoided carbon of each PKT shifted (kgCO₂e/km)</td>
<td>0.134</td>
</tr>
<tr>
<td>Commute distance (km)</td>
<td>5</td>
</tr>
<tr>
<td>Commutes per year</td>
<td>440</td>
</tr>
<tr>
<td>Life cycle of greenway (years)</td>
<td>20</td>
</tr>
<tr>
<td>Commuters required to shift for life of greenway</td>
<td>100</td>
</tr>
</tbody>
</table>

4.4 million passenger-kilometres must be shifted to offset the embodied carbon of the greenway. This is a 5km commute for 100 people over 20 years!

Manton et al (2014). *Carbon costs and savings of greenways*
Environment

Future work

- Extension of boundary condition to cradle-to-grave
- Mode of travel to greenways
- Potential carbon savings of modal shift
- Methods of reducing embodied carbon in greenways—materials, network, public transport
- Recommending methodologies for Environmental Impact
Economy

Importance of economic evaluation tools in the current economic climate

**Cycle tourism**

- Value of €54 bn across Europe in 2009
- In Ireland in 2009, cycle tourists spent €97 million
- Ireland has major potential in this area
- Great Western Greenway: direct spend of €7.2m in 2011 – supporting 55.5 jobs, creating 37.5 new jobs

Lumsdon et al (2012). *The European Cycle Route Network, EuroVelo*
Fáilte Ireland (2011). *Great Western Greenway – Economic Impact Study*
**Health:** 3 hours cycling decreases risk of all-cause mortality by 72% (Anderson et al, 2000)

**Absenteeism:** Physically active employees work 0.4 days more per year (NRA, 2011)

**Journey Ambience:** Users willing to pay €0.17/min to cycle on a greenway (UK DfT, 2010)

\[
\text{Health} + \text{Absenteeism} + \text{Journey ambience} = €1.11
\]

per km cycled

Manton & Clifford (2011). *Cycling Ireland to work*
Survey spending on Great Western Greenway

Assemble costs involved in greenway construction

Use ‘willingness to pay’ to calculate value to public

Monetise safety improvements and carbon savings?

Construction of CBA for greenways
Safety concerns are the biggest impediment to the growth of cycling in Ireland

Statistics

- In 15 years: 205 cyclists killed, 577 minor injuries, 5450 serious
- 3.5% of all road casualties
- Though cyclists make up less than 2% of road users
- 85% of cyclist casualties occur in built-up areas
- 14% cyclists casualties are caused by HGVs

Road Safety Authority (2012). Collisions data
Fáilte Ireland (2007). A strategy for the development of Irish cycle tourism
Two surveys underway to develop a quantitative Safety element

1. On-road safety
   - Mental mapping – draw route, rate sections
   - 21 question survey about on-road cycling safety
   - Traffic volumes and other data for all Galway City roads

2. Greenway safety
   - 29 question survey about greenway cycling safety
   - Conducted on Great Western Greenway

Future work

- Unpack determinants of perceived cycling risk
- Feed safety concerns into design guidance
- Recommendations for road-greenway junctions
- Safety Quality-of-Service measure and safety rating for potential routes
Review of design guidance

### Geometric design

<table>
<thead>
<tr>
<th>Geometric design</th>
<th>Recommended Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>2-3m</td>
</tr>
<tr>
<td>Design Speed</td>
<td>30 km/h</td>
</tr>
<tr>
<td>Gradient</td>
<td>0.5-5%</td>
</tr>
<tr>
<td>Crossfall</td>
<td>2%</td>
</tr>
<tr>
<td>Min. Radius of Curvature</td>
<td>25m</td>
</tr>
<tr>
<td>Min. Stopping Sight Distance</td>
<td>30m</td>
</tr>
<tr>
<td>Min. Lateral Clearance</td>
<td>Varies with topography</td>
</tr>
<tr>
<td>Min. Length of Crest Vertical Curve</td>
<td>Varies with topography</td>
</tr>
</tbody>
</table>

### Surface

- **Surface**: 20mm HRA (10mm nominal aggregate size)
- **Base**: 40mm Dense AC (20mm nominal aggregate size)
- **Sub-base**: 150mm Type A granular material

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*Manton & Clifford (2013). Review of construction and maintenance guidelines for greenways*
Design

- Not sufficient to examine best practice alone

- Based on the survey, user preferences will be established

**Future work**

- Create a rating system based on user preferences and best practice

- Create a Quality-of-Service tool for preferred design and rating for potential routes
Connectivity

- Fundamental principle of cycling routes

- Connectivity also includes: continuity, accessibility & permeability
- Connection to origin (population) and destination (employment, shopping)
- Connection to public transport
- Connection to facilities, e.g. food & drink, toilets
- Issues causing poor connectivity: walls, fences, steps etc.
Connectivity
Connectivity
Study of Galway City West

Future work
Develop a rating system for the connectivity of greenways
Integration

- Infrastructure must be shown to align with policy and plans

- International/EU, national, regional, local
- *Smarter Travel & National Cycle Policy Framework*
- NSS, NDP, RDP, Trails Strategy etc.
- City & County Development Plans, LAPs
- Other policies, e.g. obesity, carbon savings
- Integration with land use

Develop a rating system
Case Study: Mullingar-Galway

Dublin-Clifden corridor
Coast-Coast
140 km long

Issues:
- Linking towns
- Low inter urban population density
- Facilitating all users
- Tourist attractions (Clonmacnoise)
- Ground conditions (bogs)
- Size of study area (2,023 km²)
- Constraints
- Number of route options

Ideal for testing analysis
A thorough greenway route selection process is required.

This research will develop scores for: safety, value for money, environmental friendliness, quality of design, connectivity and integration with policy.

Consider weightings as angle of the spokes.

This could be an important tool for route design in Ireland and internationally.
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