


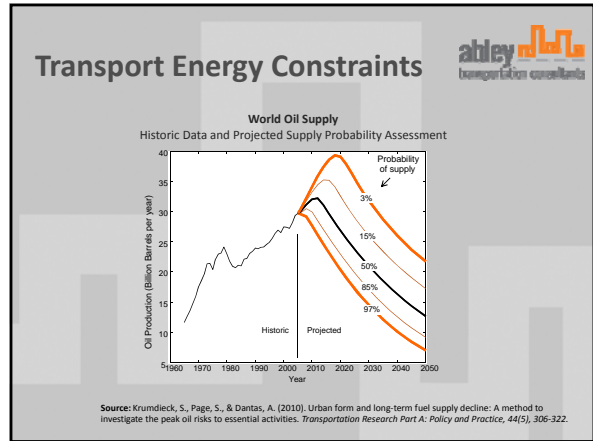


Quantifying Transport Energy Resilience: Active Mode Accessibility


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Transport Energy Constraints




- People will attempt to adapt to energy supply constraints
- However, there are limits to adaptation - defined by the transport network and geography of the urban form
- Trips that cannot be adapted must be forgone
- Previous oil incidents indicate that modern car oriented cities are not resilient

Research Objective



*Quantify the transport energy resilience
of urban forms*

Literature




Fuel Price Vulnerability:

- Dodson, J., & Sipe, N. Oil Vulnerability in the Australian City. Brisbane: Griffith University, 2005.
- Dodson, J., & Sipe, N. Shocking the Suburbs: Urban Location, Housing Debt and Oil Vulnerability in the Australian City. Brisbane: Griffith University, 2006.

Accessibility studies:

- Koenig, J. G. Indicators of urban accessibility: Theory and application. *Transportation*, 9(2), 1980, 145-172.
- Handy, S. Regional Versus Local Accessibility: Implications for Nonwork Travel. *Transportation Research Record*, 1400, 1993, 58-66.
- Levinson, D. M. Accessibility and the journey to work. *Journal of Transport Geography*, 6(1), 1998, 11-21.

Literature




Accessibility models:

- Mavoa, S. *Estimating the Social Impact of Reduced CO₂ Emissions from Household Travel Using GIS Modelling*. Paper presented at the 30th Australasian Transport Research Forum 2007.
- Yigitcanlar, T., Sipe, N. G., Evans, R., & Pitot, M. *A GIS-based land use and public transport accessibility indexing model*. *Australian Planner*, 44, 2007.
- Abley, S. *Measuring Accessibility and Providing Transport Choice*. Paper presented at the Australian Institute of Traffic Planning and Management National Conference. 2010.

Accessibility reviews:

- Bertolini, L., le Clercq, F., & Kapoen, L. Sustainable accessibility: a conceptual framework to integrate transport and land use plan-making. Two test-applications in the Netherlands and a reflection on the way forward. *Transport Policy*, 12(3), 2005, 207-220.
- Geurs, K. T., & van Wee, B. Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport Geography*, 12(2), 2004, 127-140.

Method

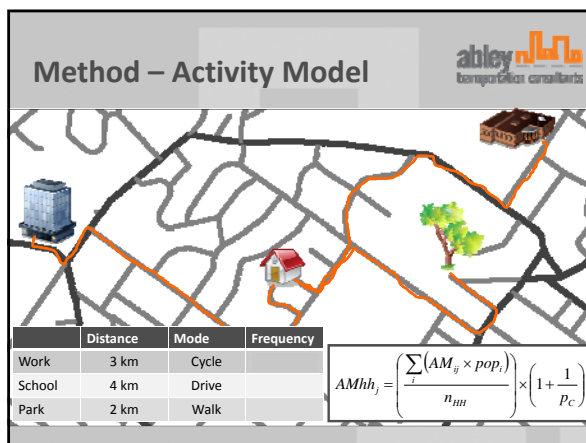
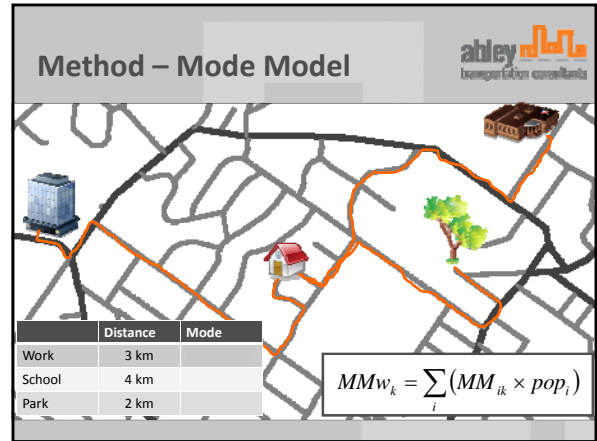


Active Mode Accessibility (AMA):

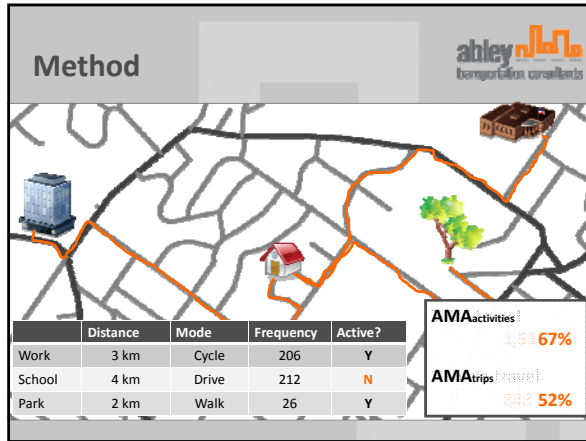
- The **proportion of activities** that can be reached by **active modes**
- **Low AMA:** activities cannot be accessed by active mode
 - reliance on private vehicles
 - high fuel input required
- **High AMA:** low fuel input required

Method



- ### Method
- Active Mode Accessibility:
 - Valid at any level
 - Percentage of **four key activities** that can be accessed by active mode
 - Primary/Intermediate School, High School, Grocery Shopping, Employment
 - Percentage of **trips** that can be met by active mode
 - Weights for destinations of greater importance



Method

The Minimum Energy Activity System is unlikely to be met in reality

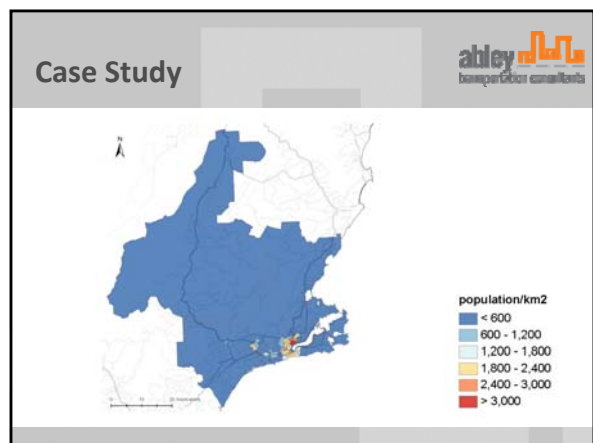
However, it is **indicative of the potential** for residents to adapt to transport energy constraints

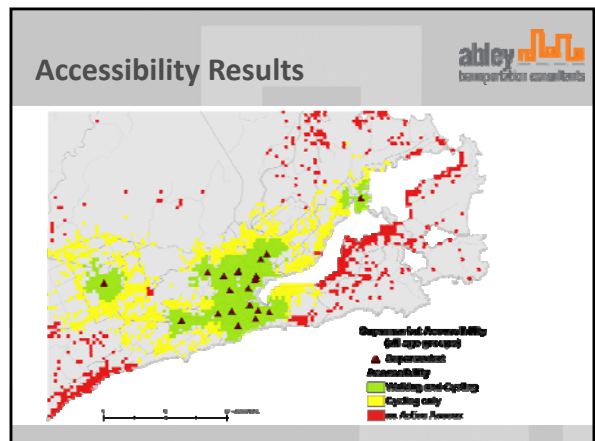
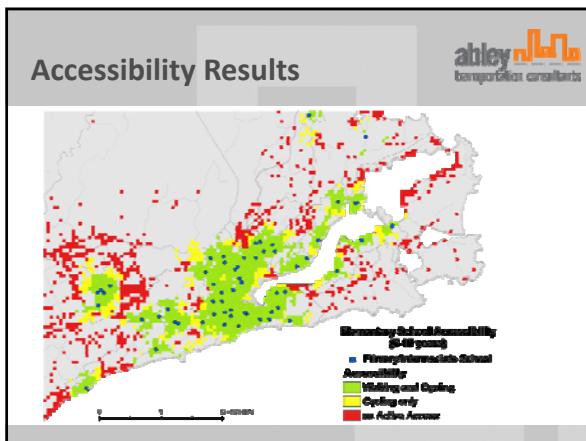
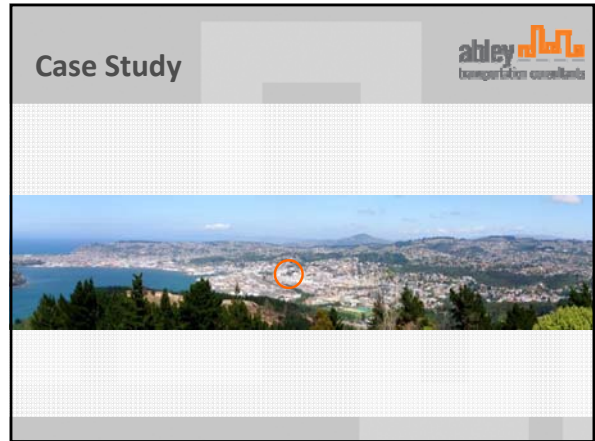
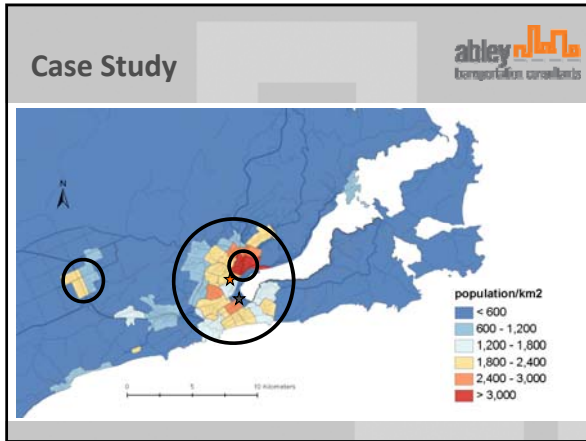
An area with an Active Mode Accessibility of zero **will not allow residents to adapt easily**, and **will not be resilient** to fuel price rises or shortfalls

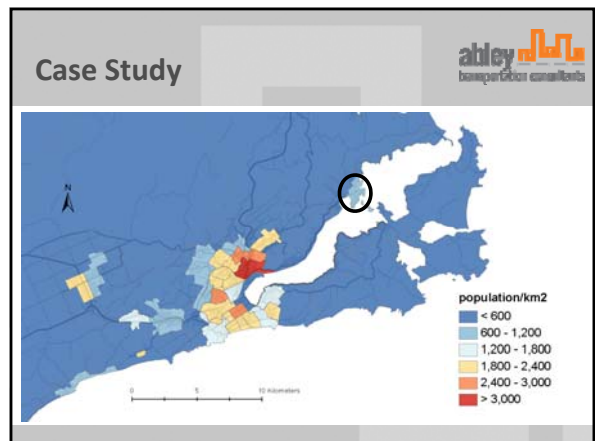
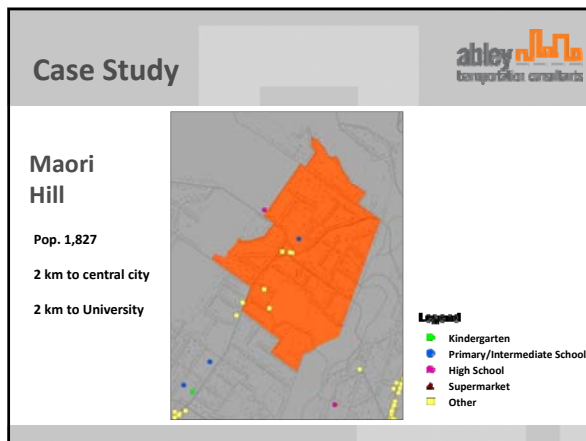
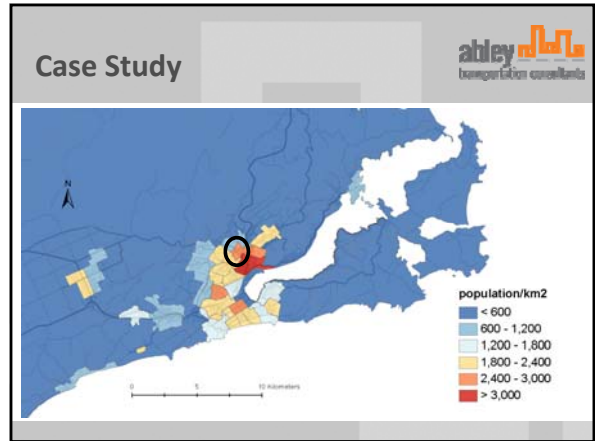
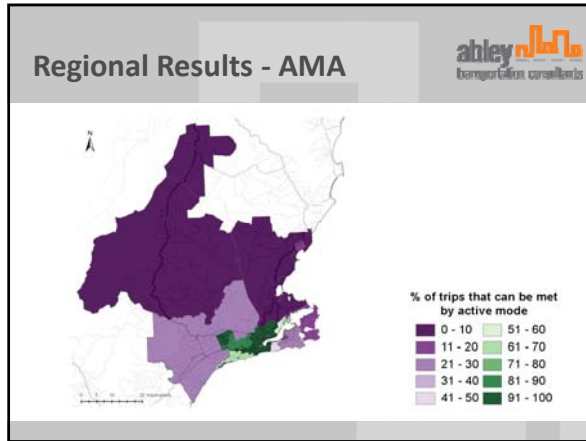
Implementation

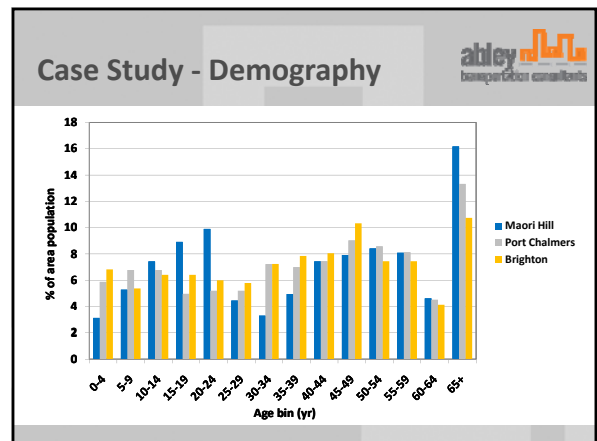
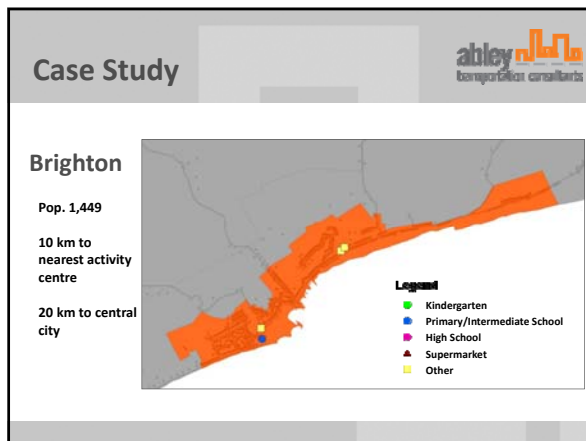
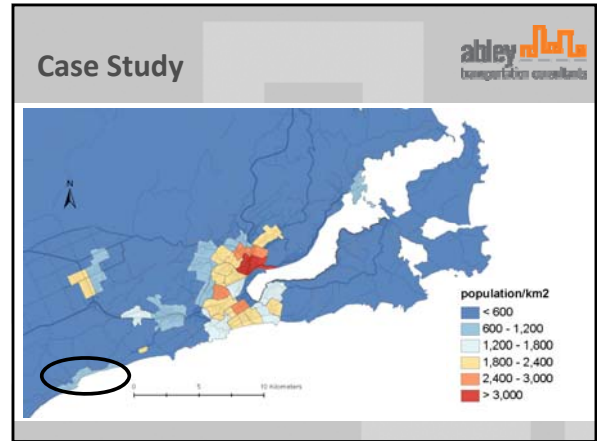
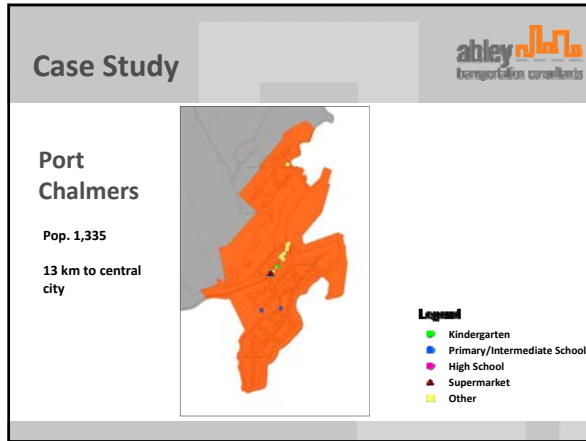
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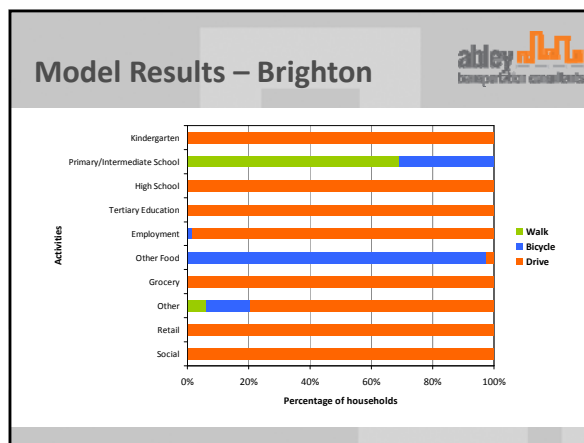
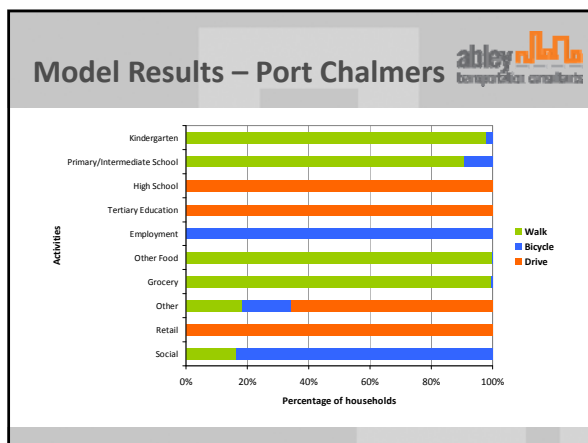
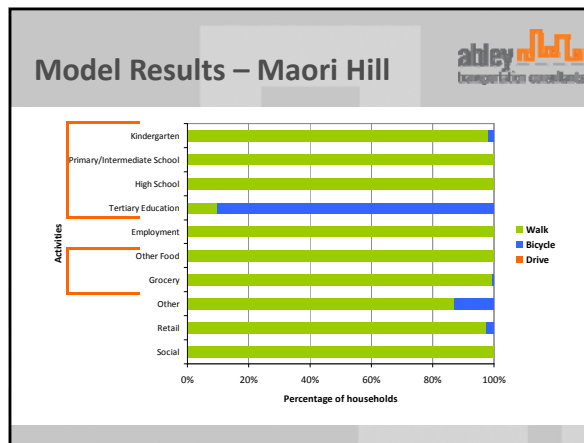
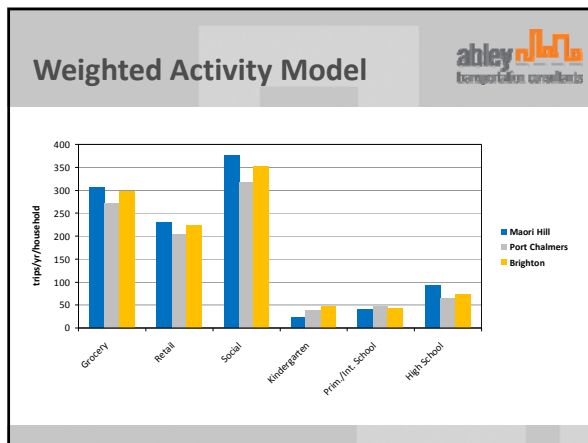
ModelBuilder













Model Results





	Maori Hill	Port Chalmers	Brighton
AMA of four Key Destinations	100 %		
AMA of Trips	100 %		

Model Results




	Maori Hill	Port Chalmers	Brighton
Minimum Travel km/household/yr	3,700		
Minimum Vehicle Travel km/household/yr	0		
Minimum Fuel L/household/yr	0		
Annual Cost % of 2006 median area household income	0 %		

- ### Dunedin Conclusions
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- Urban Dunedin City is resilient
 - Historic design
 - Limited expansion since automobile age
 - Commuter towns with low amenity are less resilient
 - Fuel Poverty
 - Ensure local-scale amenity shopping destinations are retained
 - Accessible by active modes
 - Can capture a significant number of trips

- ### Research Summary
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- A method has been developed to quantify the transport energy resilience of urban forms
 - Utilizes geography, rather than behavior, to measure the underlying potential for adaptation
 - Indicates areas that are not resilient, and explains the contributing factors

Applications



- Land Use Planning for transport energy resilience:
 - Sensitivity analysis of new developments
 - Manukau, southern Auckland
 - Plan Change Assessments
 - Christchurch rebuild
- Prioritisation of transport schemes – Cost Benefit Analysis
- Identification of public transport routes
- Evaluation of service provision

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