# Quantifying Transport Energy Resilience:
# Active Mode Accessibility

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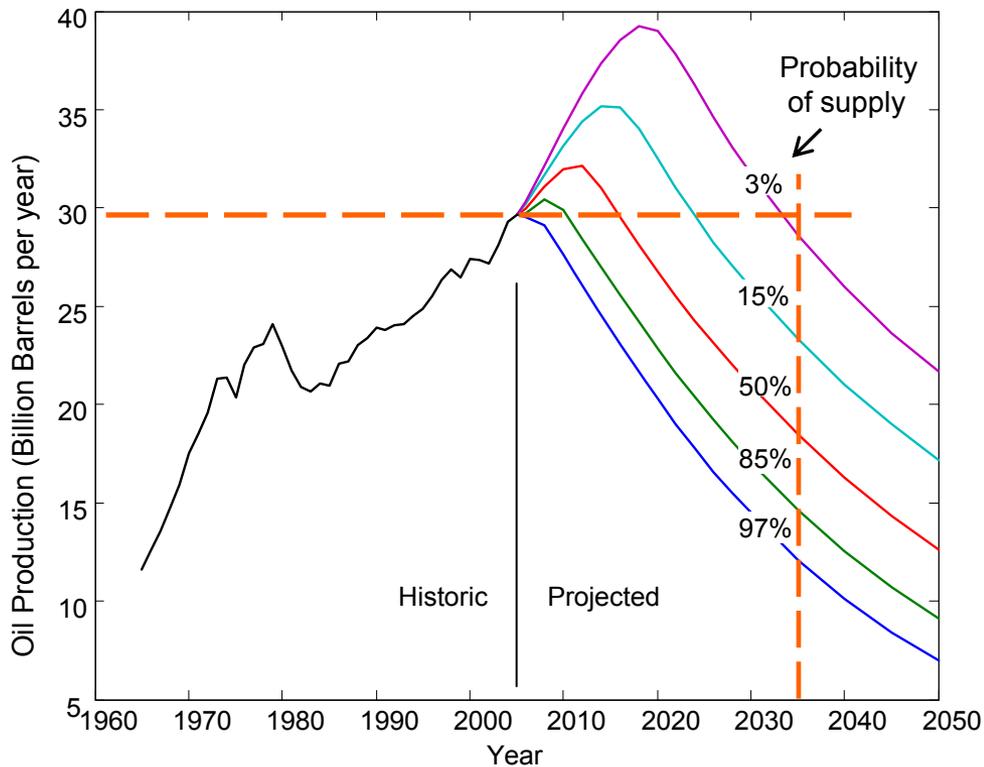
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# Energy

Energy = Coal, Petrol, Electricity, Biomass, Human Power, etc.

Transport Energy ≈ Oil

# Motivation

**World Oil Supply**
Historic Data and Projected Supply Probability Assessment



**Source:** Krumdieck, S., Page, S., & Dantas, A. (2010). Urban form and long-term fuel supply decline: A method to investigate the peak oil risks to essential activities. *Transportation Research Part A: Policy and Practice, 44(5), 306-322.*

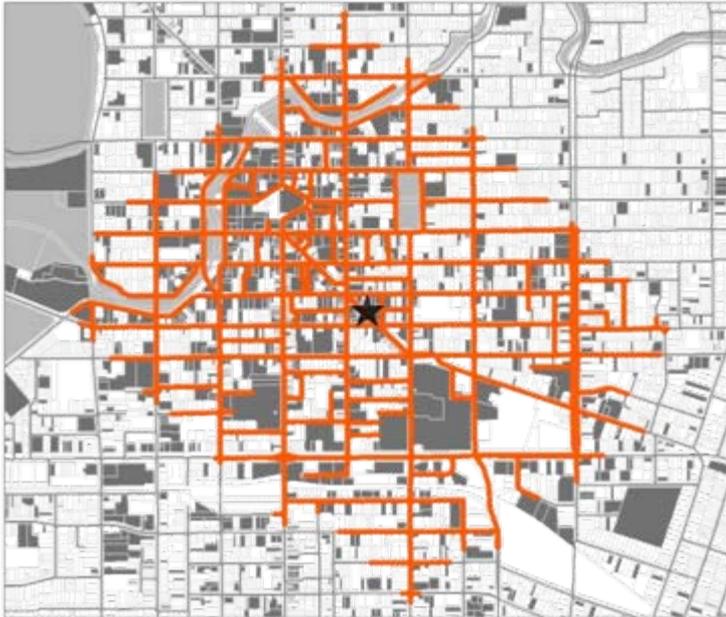# Background - Adaptation

**Low Impact**

**Change travel time**

**Shift mode**

**Change destination**

**Forgo activity**

**High Impact**

# Background



**Central City, Christchurch**

**Northwood Suburb, Christchurch**

★ Origin
— Places within 1.2km walk
█ Commercial destinations
▓ Parks

0    0.5    1 Kilometers

0    0.5    1 Miles

# Method

- Active Mode Accessibility (AMA):

  - The **proportion of activities** that can be reached by **active modes**.

  - **Low AMA:** high fuel input required

  - **High AMA:** low fuel input required

# Method

Builds upon:

- Accessibility Analysis

# Method

Builds upon:

- Accessibility Analysis

- Activity Modelling

# Method

- For every residence:

  1. Measure travel time and distance required to capture activities

  2. Select travel mode for each activity

  3. Calculate the annual travel and fuel consumption

# Method

- For every residence:

1. Measure travel time and distance required to capture activities

   **Accessibility Analysis**

2. Select the mode for each activity

   **Mode Model**

3. Calculate the annual travel and fuel consumption

   **Activity Model**

# Method

- AMA:

  - Percentage of **four key activities** that can be accessed by active mode

  - Percentage of **trips** that can be met by active mode

# Implementation - Current

# Implementation - Future

# Case Study



**Rolleston**

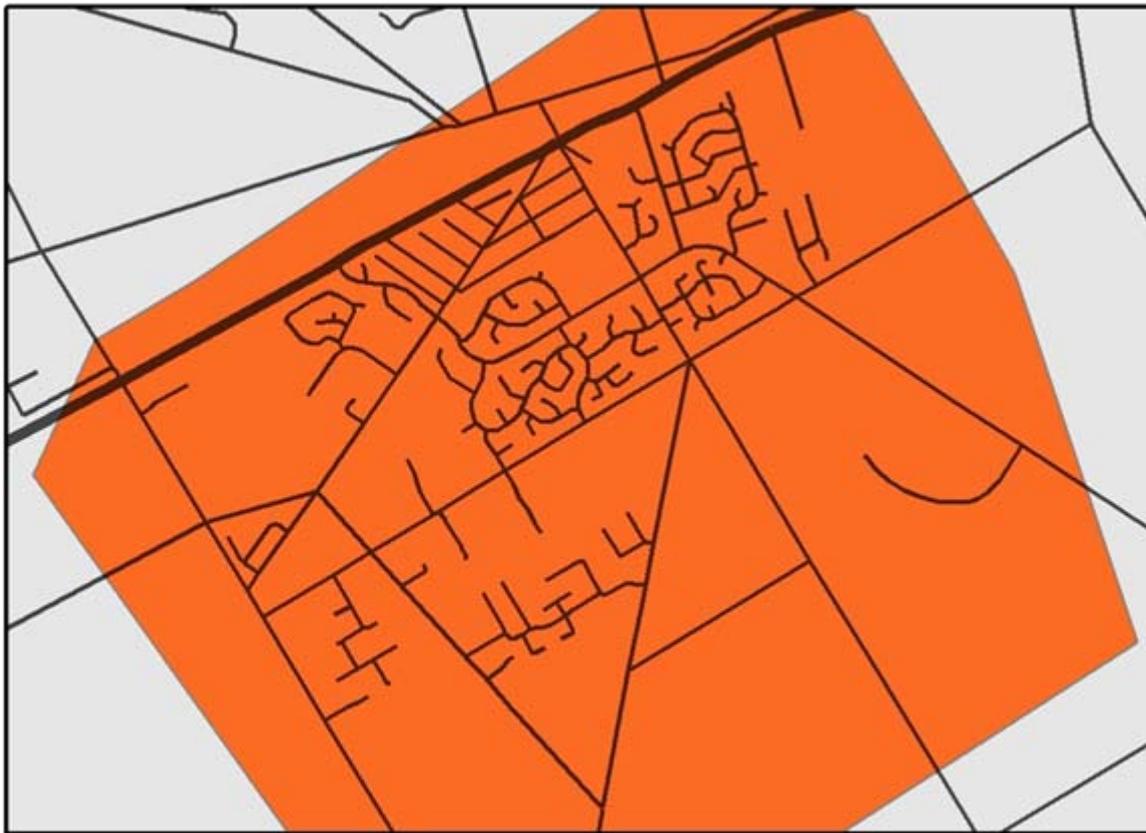Pop.: 7,000

Area: 15 sq. km

Destinations: 103

**Central City**

Pop.: 5,700

Area: 5 sq. km

Destinations: 1755
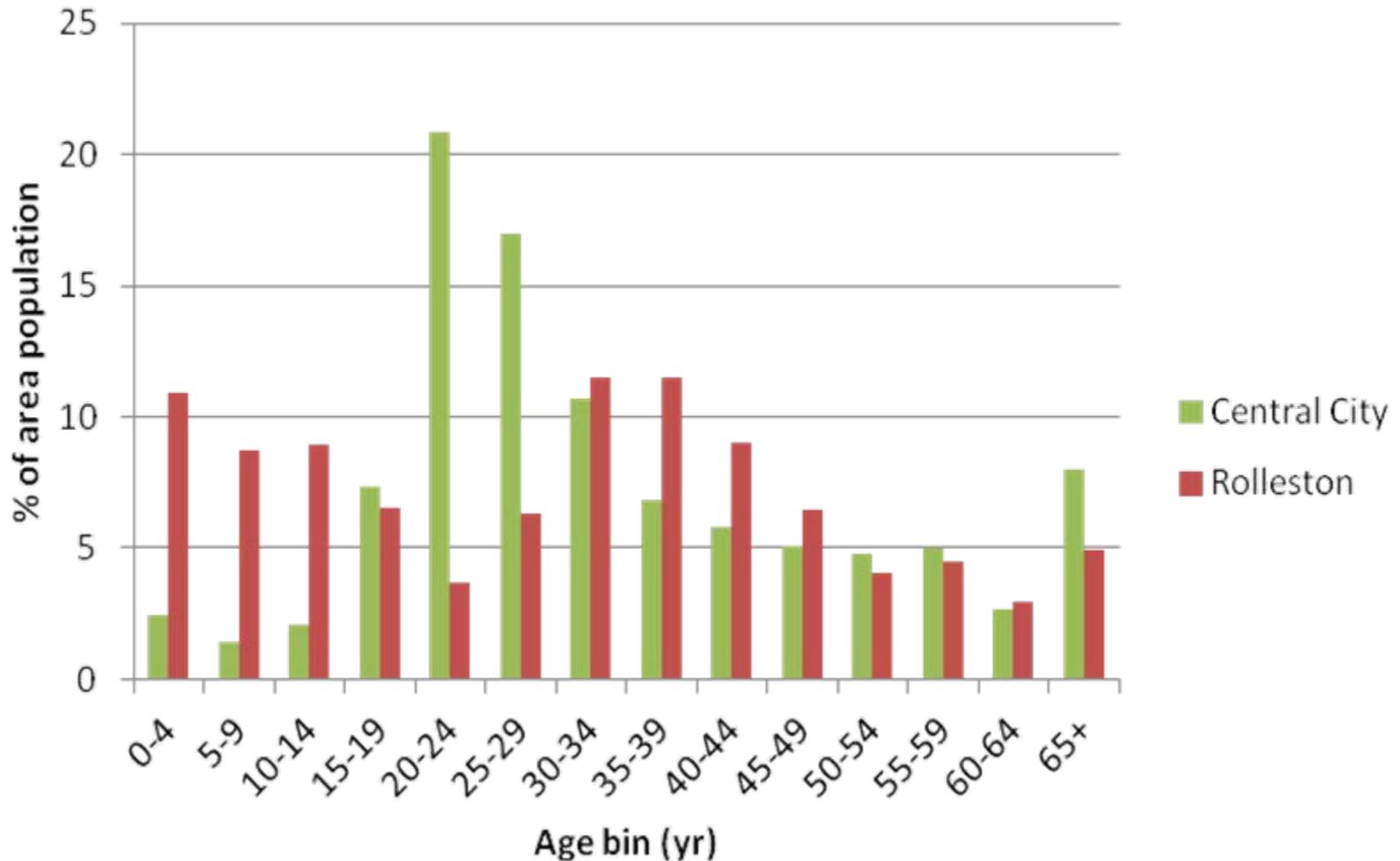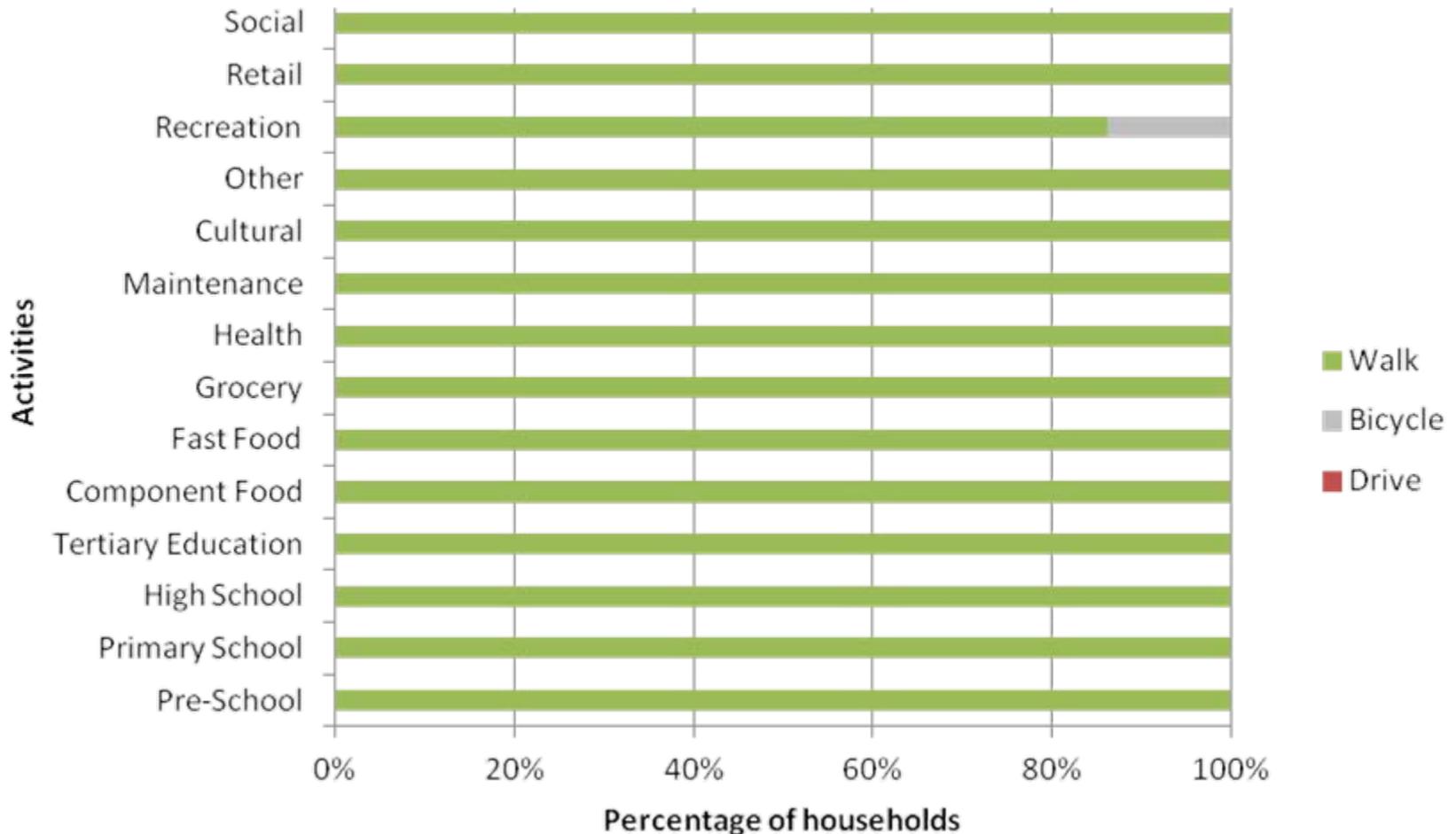
# Case Study - Networks

# Case Study - Demography

# Accessibility & Mode Model Results – Central City
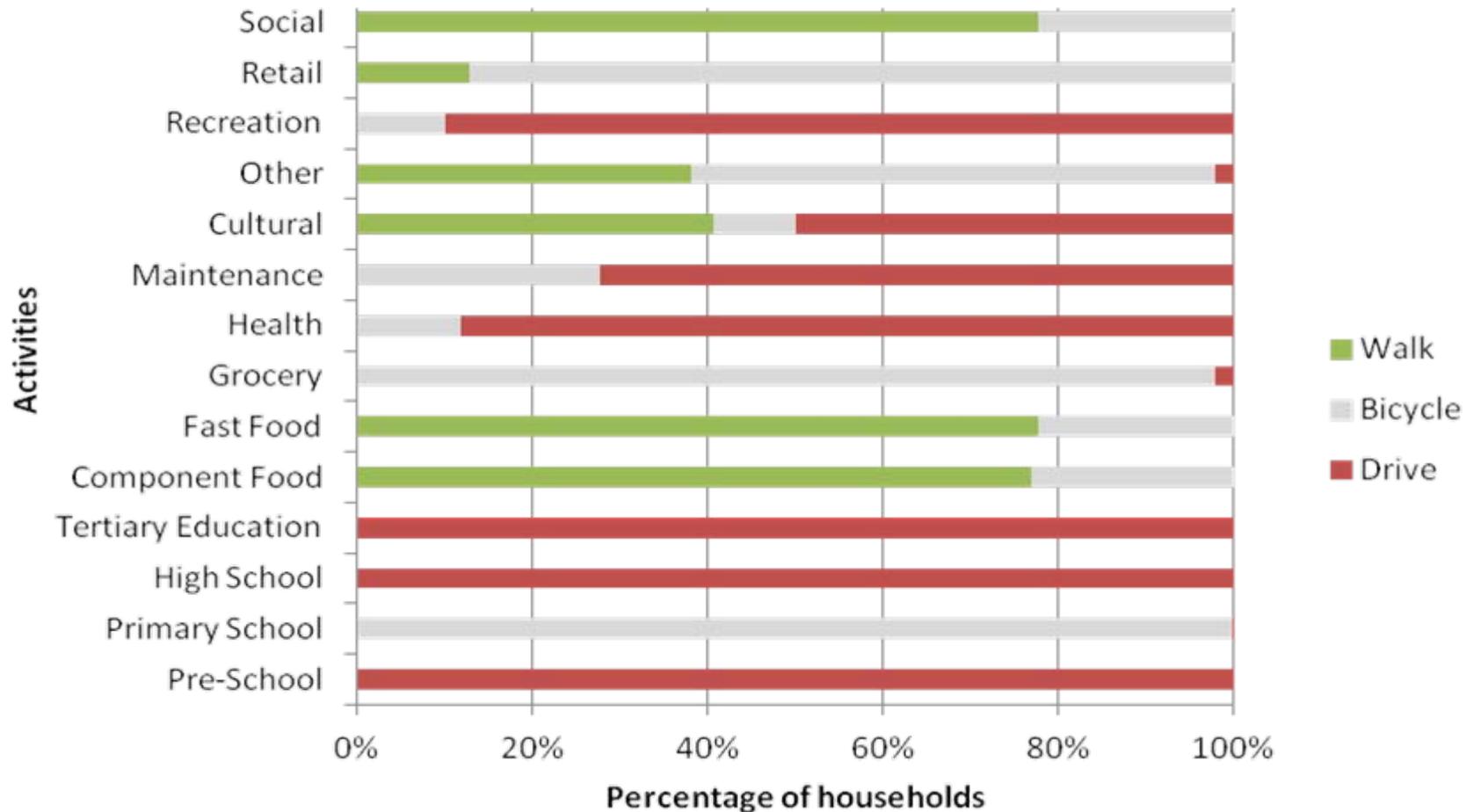
# AMA Results – Central City

- AMA of key destinations:

  **100%**

- AMA of trips:

  **100%**

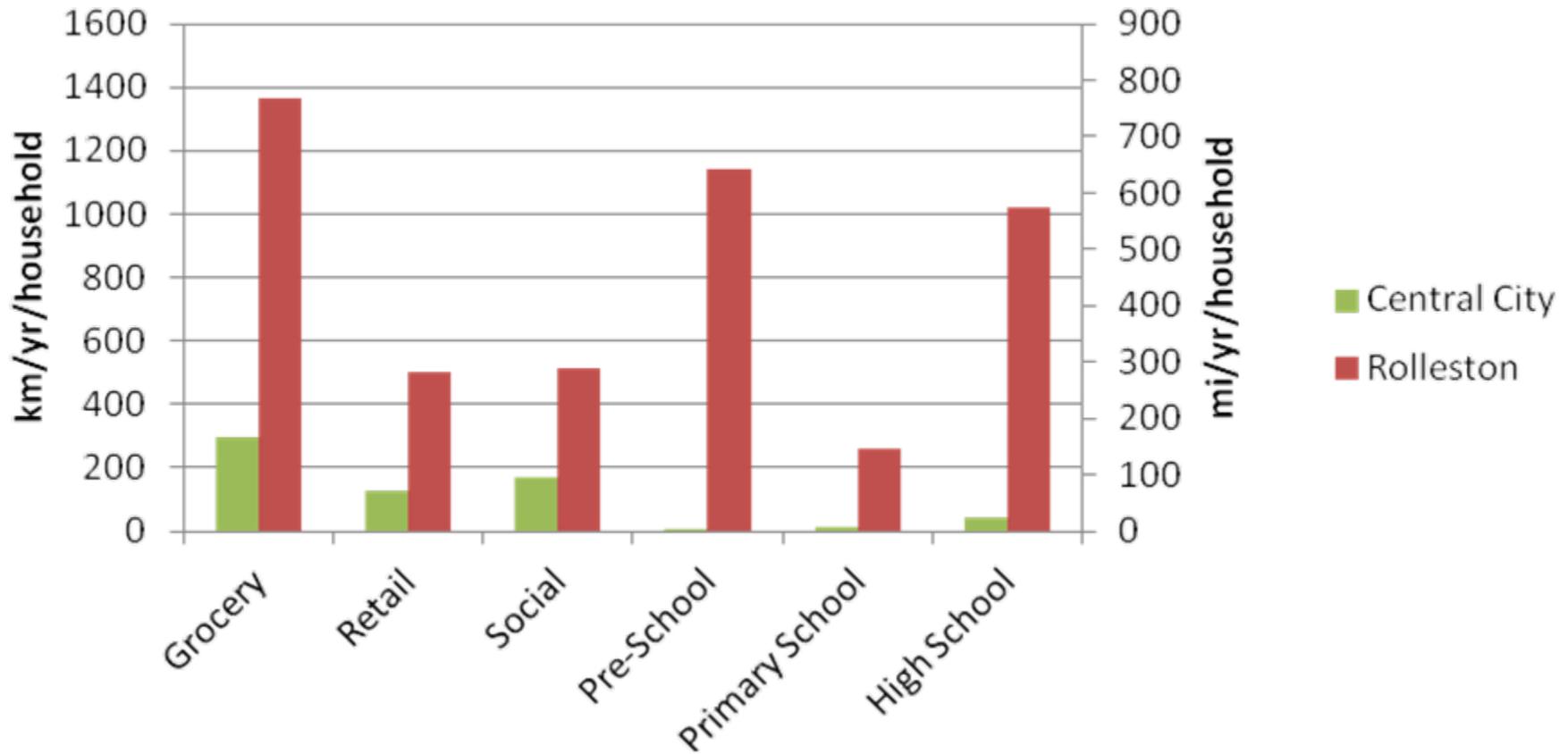# Accessibility & Mode Model Results – Rolleston

# AMA Results – Rolleston

- AMA of key destinations:

## 66%

- AMA of trips:

## 59%

# Activity Model Results

# Results

| | Central City | Rolleston |
|---|---|---|

# Results

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|---|---|---|
| **Minimum travel demand (all modes)** | 1,100 – 2,500 km/year/household | 14,000 – 22,000 km/year/household |

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| **Minimum travel demand (all modes)** | 1,100 – 2,500 km/year/household | 14,000 – 22,000 km/year/household |
| **Minimum VKT** | 0 km/year/household | 9,100 km/year/household |

# Results

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| **Minimum travel demand (all modes)** | 1,100 – 2,500 km/year/household | 14,000 – 22,000 km/year/household |
| **Minimum VKT** | 0 km/year/household | 9,100 km/year/household |
| **Minimum Fuel** | **0** L/year/household | **911** L/year/household |

# Conclusions

- Quantifies transportation energy resilience

- Indicates facilities that are inaccessible without private vehicles

- Future: Transport Energy Footprinting