The Fifth Mode
Trip and System Characteristics of One-Way Car Sharing in Metro Vancouver, BC

Photo: gizmag.com
Outline

1. Why Study Car Sharing?
2. Car Sharing in Metro Vancouver
3. Car2Go One-Way Car Share
4. Study Methodology
5. Car2Go System Usage
6. Vehicle Availability and Trip Patterns by Period
7. Car Share Economic Benefits
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What is Car Share?

Car share programs provide a network of passenger vehicles to members who can access them on an as-needed basis for a rate based on time and/or distance.

Car share members gain the benefits of private vehicle use without the costs and responsibilities of ownership.

**One-Way**
- Vehicle can be picked up and dropped off in different locations
- Billing by the minute / hour / day
- Suitable for leisure + commute trips

**Two-Way**
- Vehicle must return to “home” parking spot to end rental
- Billing by the hour / day
- Suitable for leisure, special interest trips
Why Study Car Sharing?

*Car sharing supports the broader social good*

Car Sharing:

- Promotes a more efficient use of vehicles (reduce vehicle parking/dead time)
- Supports a private vehicle-free lifestyle, alongside transit and active transportation
- Increases transportation choices
- Provides access to vehicles for those who cannot afford to buy
- Can defer the purchase of a first or second vehicle
- Satisfies a variety of policy goals:
  - Reduction in # of vehicles on the road
  - Reduction in need for parking

![Image](https://example.com/urban_systems)
Why Study Car Sharing?

Car sharing is a rapidly expanding component of the transportation ecosystem

- Advances in technology and new business practices have taken car sharing beyond a “niche” transportation alternative

![Member Growth in the Americas](image1)

<table>
<thead>
<tr>
<th>Year</th>
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<th>Mexico (m)</th>
<th>Canada (m)</th>
<th>United States (m)</th>
<th>The Americas (m)</th>
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<td>1,200,000</td>
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**Metro Vancouver Car2Go Membership**

- March 2014: 40,000
- March 2015: 84,000

**Metro Vancouver Car Share Fleet**

- January, 2015: 1,255
- July, 2015: 2,131
Why Study Car Sharing?

Is Car Sharing an emerging *Fifth Mode* in Urban transportation?

1. Walking
2. Cycling
3. Public Transit
4. Private Auto
5. Car Share?
Car Sharing in Metro Vancouver

- Metro Vancouver is widely considered to be a North American leader in car sharing

<table>
<thead>
<tr>
<th>Car Share Operator</th>
<th>System Type</th>
<th>Vehicle Type</th>
<th>Service Area</th>
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<tbody>
<tr>
<td>ZipCar</td>
<td>2-Way. Vehicle must be returned to “home” parking space.</td>
<td>Multiple makes and models</td>
<td>Vancouver, UBC, North Vancouver, Richmond, Burnaby, SFU</td>
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<tr>
<td>Modo</td>
<td>2-Way. Vehicle must be returned to “home” parking space.</td>
<td>Multiple makes and models</td>
<td>Vancouver, UBC, North Vancouver, Richmond, Burnaby, New West, Surrey, Coquitlam, Port Moody, SFU</td>
</tr>
<tr>
<td>Car2go</td>
<td>1-Way. Park in any unmetered public space.</td>
<td>Smart Car (2-seat)</td>
<td>Vancouver, UBC, North Vancouver, Richmond</td>
</tr>
<tr>
<td>EVO (BCAA)</td>
<td>1-Way. Park in any unmetered public space.</td>
<td>Toyota Prius</td>
<td>Central Vancouver</td>
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</table>
Car Sharing in Metro Vancouver

Car Share Vehicles in Metro Vancouver

<table>
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<tr>
<th>Car Share Operator</th>
<th>Membership</th>
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<tr>
<td>ZipCar</td>
<td>Unknown</td>
</tr>
<tr>
<td>Modo</td>
<td>11,000</td>
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<tr>
<td>Car2go</td>
<td>89,000</td>
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<tr>
<td>EVO (BCAA)</td>
<td>Unknown</td>
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Metro Vancouver Car Share Study (Nov, 2014):

- First comprehensive analysis of car sharing in the region
- Evidence gathered from discussions with car share providers + two online surveys of car share households (3,405 responses) and apartment households (2,054 responses)

- Primary results:
  - Vehicle Reduction: 3 to 11 private vehicles eliminated for every car share vehicle
  - Changes in VKT
  - Key motivations for joining a car share: cost, convenience compared to transit, additional mobility, availability of car share vehicles
Car2Go One-Way Car Share

- Point-to-point travel with billing by the minute
- Cost: 41 cents per minute includes gas, insurance; negligible annual fee ($2) + $1 per use fee
- Served by a fleet of 1,250 2-seater Smart cars
- *Park almost anywhere* in Home Area at no additional cost (includes permit/resident only spots, designated car2go only locations Downtown/UBC)

Car2Go’s business model:
- Provides travellers with freedom of movement of the private automobile without the associated burden of paying for parking
- Allows for unbundling of trip segments, giving the traveller the flexibility of using a car when it is most needed, and discarding it where it is less efficient
Car2Go One-Way Car Share

- Easy to use smartphone app and website allows customers to locate and book a vehicle within seconds
- Vehicle location information updated constantly
- Vehicle reservations held for 30 minutes at no charge
- A reserved vehicle can only be unlocked by the member holding the reservation
Study Methodology

• This study uses geo-snapshots of Car2Go’s publically available real time vehicle location information as a primary input to determine system and travel characteristics.

• Snapshots record the precise lat-long location of available vehicles by license plate at various time intervals throughout the day on weekdays in kml format.

• Frequent geo-snapshots are then analyzed in Excel and GIS to estimate/reveal:
  – System usage patterns
  – Average trip distance
  – Vehicle availability by period
  – O-D trip patterns by period
Study Methodology

- Snapshots taken at hourly intervals for 24 hours over 6 weekdays in January, 2015
- Hourly data is supplemented by snapshots taken every minute during the AM peak (8-9AM), midday (1-2PM), PM peak (5-6PM), and evening (7-8PM) periods

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<tbody>
<tr>
<td>AM Peak Every Minute (8 – 9 AM)</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
<td>Midday Every Minute (1 – 2 PM)</td>
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<td>PM Peak Every Minute (5 – 6 PM)</td>
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<td>Evening Every Minute (7 – 8 PM)</td>
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<td>✓</td>
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<td>✓</td>
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In January 2015 Car2Go had a fleet of 750 vehicles and supported 6,400 trips in Metro Vancouver each weekday. Or 9 trips per car2go vehicle.
System Usage

- Car2Go carries about as many people each day as TransLink Routes 33 or 44 or the entire Abbotsford or Prince George BC Transit systems.
System Usage

- Car2Go system usage exhibits a typical commute-oriented bi-modal pattern with a clear AM and PM peak period
- Significant early evening usage is observed
- System usage is highest in the PM peak and early evening periods (500 trips per hour)
System Usage

- Fleet utilization peaks near 70% in the PM peak period at 0.7 trip per vehicle
Average Trip Length

- Car2Go has a **3.8km average trip** length with minor variations between travel periods.
- Despite the size of the service area, one-way car sharing is being used for short-distance trips.
- Car2Go average trip length is comparable to bicycle trips, and significantly less than transit or auto trips.

![Average Weekday Trip Distance by Mode](chart.png)

*City of Vancouver-Origin Trips (2011 Trip Diary)*
Vehicle Availability Patterns
Vehicle Availability

7 AM

- Available vehicles distributed throughout service area
- Clusters in high density inner residential neighbourhoods:
  - the West End
  - Coal Harbour
  - Commercial Drive
  - Main / Fraser Streets (6th to 33rd)
  - Kitsilano
  - Fairview
Significant shift in availability pattern as a result of heavy AM Peak use for commute purposes

- Clustering in employment centres / universities:
  - Downtown
  - UBC
  - Langara
  - central Broadway
  - Coal Harbour
  - Gastown
  - Oak Street Hospitals
  - North Shore Auto Mall

- Evidence of clustering near select SkyTrain stations

- Limited / no availability in high density residential neighbourhoods
Vehicle Availability

4 PM

- In the midday, vehicles disperse through the central core as they’re used for non-commute oriented travel
- Vehicles are well balanced between employment areas and high density inner residential neighbourhoods
Vehicle Availability

7 PM

- Vehicles have largely returned to high density inner residential neighbourhoods
- Limited availability Downtown and at UBC
- Some clustering occurring at service area boundaries, particularly on the North Shore
Trip Patterns by Period

Online interactive webmaps available here: http://arcg.is/1HhlLRQ
AM Peak (8 AM – 9 AM) O / D and Trip Patterns

- Short, core area trips
  - Central Broadway – Downtown
  - Inner Downtown
  - Diagonal E-W trips between 16th and 4th Avenues
- Trips are too short for conventional buses to be competitive
Midday (1 PM – 2 PM) O / D and Trip Patterns

- Overall fewer trips than AM peak
- Diffuse trip patterns include:
  - Core area trips
  - Trips to / from UBC
  - Diagonal trips (difficult to satisfy on transit without a transfer)
PM Peak (5 PM – 6 PM) O / D and Trip Patterns

- Very heavy trip use including:
  - Short, core area trips within Downtown, btw Downtown and central Broadway
  - Trips to / from UBC
  - West End and Downtown to Kits
  - Diagonal E-W trips between 16th and 4th Avenues

Tuesday Jan 13, 2015
Evening (7 PM – 8 PM) O / D and Trip Patterns

- Short, core trips
- Focus of gravity changes to West End, Main Street (Broadway – King Edward), Kitsilano

Wednesday Jan 21, 2015
Peer Comparison - Calgary

- 550 vehicles
- Park anywhere scheme (including at meters)
Calgary: Vehicle Availability

4 AM

- Clustered in inner city residential neighbourhoods 2 – 4 km from Downtown
- Limited availability Downtown

5 week days of data represented; July 2015
Calgary: Vehicle Availability

10 AM

- Almost all vehicles downtown
- Limited availability in inner city residential ring

5 week days of data represented; July 2015
Car sharing services result in significant economic savings

**Vehicle Ownership Costs (Midsize Car / Honda Civic)**

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Cost</th>
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<tbody>
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<td>Fuel</td>
<td>$2,086</td>
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<tr>
<td>Insurance</td>
<td>$1,529</td>
</tr>
<tr>
<td>License &amp; Registration</td>
<td>$43</td>
</tr>
<tr>
<td>Depreciation &amp; Maintenance</td>
<td>$6,729</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$10,343</strong></td>
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**Source:** BCAA, 2015

**Car Share Annual Costs**

<table>
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<th>Cost Category</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Car share cost</td>
<td>$0.50 / minute</td>
</tr>
<tr>
<td>Assume 2 average 4 km trips (15 mins)</td>
<td>$15 / day</td>
</tr>
<tr>
<td>Annual Car Share Cost</td>
<td>$5,475 / year</td>
</tr>
<tr>
<td>TransLink 1 Zone Pass</td>
<td>$1,092 / year</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$6,567</strong></td>
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$3,775 savings per person
Car Share Economic Benefits

- Car sharing services results in significant regional economic savings

<table>
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<th>Regional Benefit</th>
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<td>Savings per private vehicle replaced</td>
<td>$3,775</td>
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<tr>
<td>Private vehicle reduction per car share vehicle (Source: Metro Vancouver Car Share Study)</td>
<td>4 – 10</td>
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<td>Number of Car Share Vehicles in Metro Vancouver</td>
<td>2,130</td>
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<tr>
<td>TOTAL REGIONAL ECONOMIC BENEFIT</td>
<td>$40 to 70 M</td>
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Core Findings

- Car2Go accommodates 6,400 discrete trips each weekday (~9 trips per vehicle per day)
- Significant traditional peak period usage
- Average trip distance: 3.8km
- Despite an extensive service area, most trips occur within central core
- Car share services result in regional savings of $40 – 70 million per year
Core Findings

- One-way car share supports public transit by catering to short distance travel that is not well suited to transit
- One-way car share trips are occurring in areas where:

<table>
<thead>
<tr>
<th>Observation</th>
<th>Reason</th>
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<tbody>
<tr>
<td>1. Pay parking policies are in effect or parking is limited</td>
<td>Disincentive to private auto travel</td>
</tr>
<tr>
<td>2. Neighbourhood population / employment density is high</td>
<td>Supports high turnover required for success</td>
</tr>
<tr>
<td>3. Neighbourhoods support a variety of land uses</td>
<td>Improves turnover; shorter distances to common destinations</td>
</tr>
<tr>
<td>4. The public transit network is mature</td>
<td>Lower vehicle ownership rates; established alternatives to driving private vehicles</td>
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<tr>
<td>5. Car share vehicles are readily available</td>
<td>Vehicle ubiquity ensures travel demands can be predictably satisfied; reinforces traveller preference for one-way car sharing as a mode of choice</td>
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</table>
Acknowledgements: This study would not have been possible without the hard work and ingenuity of Dillan Collins, Bill Gushue, and Jennifer Elliot

Thank you! 😊

Questions / Comments

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