It’s Not Your Father’s Transportation Program
Keys to the Future
3 Keys

Energy
Public Health
Modern Streets
1

Energy
Petroleum Dependency
How petroleum is used in the US

- 71% transportation
- 29% other

EIA, 2008
Sources of energy for transportation in the US

95% petroleum

5% other

EIA, 2008
Our transportation systems are almost entirely dependent on oil.
Where our oil comes from

2008 US Net Petroleum Trade Deficit: $300 B

EIA, 2008
Our transportation systems are almost entirely dependent on oil imported.
“Peak Oil”
The Original Hubbert Curve

- Proven reserves: $250 \times 10^9$ bbls
- Cumulative production: $90 \times 10^9$ bbls
- Future discoveries: $910 \times 10^9$ bbls

M. King Hubbert (1956)
US Oil Consumption (million barrels per day)

EIA, Annual Energy Outlook 2001; "Potential Oil Production from the Coastal Plain of ANWR," - EIA Reserves & Production Division
Petroleum Demand by World Region

India & China will double their demand for petroleum by 2030

The oil is not gone...

...but the cheap oil is gone.
Those were the days!
BP’s Thunder Horse Field Production Facility Cost: $1 billion
BP’s Thunder Horse Field

7,000 feet
Figure 5.21  Crude Oil Refiner Acquisition Costs, 1

Summary

Nominal Dollars\(^1\) per Barrel

Source: Energy Information Administration
# Production Cost – Sources of Oil

## Production Cost Per Barrel of Oil - 2007

<table>
<thead>
<tr>
<th>Source</th>
<th>Cost per Barrel of Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Shale</td>
<td>$57</td>
</tr>
<tr>
<td>Liquefied Coal</td>
<td>$35</td>
</tr>
<tr>
<td>Synfuel</td>
<td>$26</td>
</tr>
<tr>
<td>Tar Sands/Heavy Oil</td>
<td>$23</td>
</tr>
<tr>
<td>Enhanced Recovery</td>
<td>$16</td>
</tr>
<tr>
<td>Conventional Oil</td>
<td>$9</td>
</tr>
</tbody>
</table>

Source: Brandt & Farrell, UC Berkeley
Will energy prices control our economic growth?
Figure 3: Energy and Income, by Country, Income, and Population (2005)

Source: Energy Pathways for the California Economy, UC Berkeley, June 2009
We have used cheap energy to drive economic growth.

Energy Consumption per Real Dollar² of Gross Domestic Product, 1949-2008


Billion Nominal Dollars¹

² Chain 2005

¹ Nominal 2005
Volatile Gas Prices
Oil prices rise, economy slows down.

Oil prices drop, economy rebounds.

Rate of economic growth

Oil price per barrel
Oil price per barrel

“playing ping pong on a train”
<table>
<thead>
<tr>
<th>Fuel</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Oil</td>
<td>$80/barrel</td>
</tr>
<tr>
<td>Gasoline</td>
<td>$3.00/gallon</td>
</tr>
</tbody>
</table>
World’s Two Largest Companies

$328 b
PetroChina

$315 b
Exxon Mobile

Based on market capitalization on 3/23/10

Source: New York Times 3/24/10
Maybe technology will save us?
Potential Reduction in Petroleum Consumption Through Technology

Million barrels per day

- CAFE increases include light trucks
- Beyond 2025, EIA data extrapolated

Source: NREL
Electric cars have a role to play, but...

...will be expensive and...

...will create energy demand issues.
Total Motor Vehicles in Service in US in 2010: 250,000,000
Total Electric Autos in Service by End of 2012: 100,000

0.04%
We have not “run out of” oil
The stone age did not end...
...because we “ran out of” stones
Worldwide supply of oil

1.3 trillion barrels

42 years
Worldwide supply of oil

Daily demand

Daily production capacity

mbls/day

Time
The oil is not gone...

...but the cheap oil is gone.
US travel behavior is already changing...

VMT – Vehicle Miles of Travel
United States

**Population & VMT**

- **Population (millions)**:
  - 1955: 166
  - 1980: 227
  - 2005: 300

- **VMT (trillions)**:
  - 1955: 0.6
  - 1980: 1.5
  - 2005: 3.0

Percentage increases:
- Population: 178%
- VMT: 500%
United States
Annual Rate of Change in VMT

June – July

1975-1985: 3.35%
1985-1995: 3.59%
1995-2005: 2.39%
2005-2006: 0.06%
2006-2007: 0.03%
2007-2008: 2.80%
2008-2009: 0%
Daily Per Capita Travel

- Family/Personal: 43%
- Social/Recreational: 27%
- Church/School: 10%
- Commuting: 16%
- Other: 4%

Source: 2001 NHTS
Daily Miles of Travel Per Capita

Commute Trips
- 1977: 5.2
- 1983: 5.0
- 1990: 6.5
- 1995: 8.7
- 2001: 7.7

Change: +2.5

Discretionary Trips
- 1977: 20.8
- 1983: 20.1
- 1990: 28.4
- 1995: 30.0
- 2001: 32.6

Change: +11.8

(NHTS)
Figure 1b. U.S. Vehicle Miles Traveled Per Capita, Annualized and Real Gasoline Pump Prices, January 1991–September 2008

Source: Traffic Volume Trends and Energy Information Administration
Annual Sales: New Motor Vehicles

United States

- 1994: 15.4
- 1999: 16.9
- 2004: 16.9
- 2009: 10.4

China

- 2009: 13.6

Source: Bureau of Transportation Statistics
BOTTOM LINE:

We are entering the Post Petroleum Era, ready or not.
Public Health
US Health Care
% of GDP

- 1960: 5.1
- 1970: 7.0
- 1980: 8.8
- 1990: 12.1
- 2001: 14.1
- 2007: 16.3
- 2017: 19.5
- 2020: >20

Transportation: 9.5%

Annual Health Care Costs/Capita

- Germany: $2,983
- Australia: $2,886
- Denmark: $2,743
- France: $3,048
- Ireland: $2,455
- Japan: $2,249
- Sweden: $2,745
- Switzerland: $3,847
- United Kingdom: $2,317
- Canada: $2,998
- United States: $5,711

Source: Kaiser Family Foundation, Visual Economics, 2010
Average Life Expectancy

Japan  82.1
Germany  79.0
Switzerland  81.3
United Kingdom  79.0
United States  77.0

Source: Kaiser Family Foundation, Visual Economics, 2010
Scale – United States Economy

($ Billions/Year)

$ 407

Transportation impact on public health

$ 199

Public sector transportation expenditures
Obesity
1986

Map of the United States showing the percentage of the population affected by a certain condition in 1986.

- **No Data**
- **<10%**
- **10%–14%**

The map highlights the states with different color intensities indicating the percentage range.
Obesity Epidemic

- Significant differences between states
- Significant differences between local places
Health Indicators – Adult Obesity

**ARIZONA**
- Coconino: 22%
- Maricopa: 23%
- Pima: 21%
- Pinal: 28%

**NEW MEXICO**
- Sandoval: 22%
- San Miguel: 19%
- Santa Fe: 13%
- Torrance: 21%

**CALIFORNIA**
- Calaveras: 23%
- Mendocino: 20%
- San Bernardino: 27%
- San Luis Obispo: 22%

**COLORADO**
- Adams: 24%
- Fremont: 20%
- Larimer: 17%
- Mesa: 20%
<table>
<thead>
<tr>
<th>County</th>
<th>Poor Health Rate</th>
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<tbody>
<tr>
<td>Coconino</td>
<td>11%</td>
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<tr>
<td>Maricopa</td>
<td>15%</td>
</tr>
<tr>
<td>Pima</td>
<td>14%</td>
</tr>
<tr>
<td>Pinal</td>
<td>17%</td>
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<tr>
<td>Sandoval</td>
<td>15%</td>
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<tr>
<td>San Miguel</td>
<td>24%</td>
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<td>Santa Fe</td>
<td>13%</td>
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<td>Torrance</td>
<td>23%</td>
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<tr>
<td>Calaveras</td>
<td>23%</td>
</tr>
<tr>
<td>Mendocino</td>
<td>20%</td>
</tr>
<tr>
<td>San Bernardino</td>
<td>27%</td>
</tr>
<tr>
<td>San Luis Obispo</td>
<td>22%</td>
</tr>
<tr>
<td>Adams</td>
<td>18%</td>
</tr>
<tr>
<td>Fremont</td>
<td>15%</td>
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<tr>
<td>Larimer</td>
<td>10%</td>
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<tr>
<td>Mesa</td>
<td>12%</td>
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</table>
### Issues Influencing How Americans Vote

<table>
<thead>
<tr>
<th>Issue</th>
<th>% Very Important + Somewhat Important</th>
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<tr>
<td>Economy</td>
<td>96%</td>
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<tr>
<td>Government Ethics</td>
<td>96%</td>
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<tr>
<td>National Security</td>
<td>92%</td>
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<tr>
<td>Social Security</td>
<td>89%</td>
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<td>Taxes</td>
<td>88%</td>
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<td>Education</td>
<td>88%</td>
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<tr>
<td>Health Care</td>
<td>87%</td>
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<tr>
<td>Immigration</td>
<td>87%</td>
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<tr>
<td>War in Iraq</td>
<td>83%</td>
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<tr>
<td>Abortion</td>
<td>64%</td>
</tr>
</tbody>
</table>

Source: Rasmussen Reports, May 2010
Increased Exposure to Health Care Costs

Figure 1B. Percent distribution of the total population, by age: United States, 1980, 2007, 2050

- 1980: 18–44 years (41%), 45–64 years (20%), Under 18 years (28%), 75 years and over (7%)
- 2007: 18–44 years (38%), 45–64 years (25%), Under 18 years (6%), 75 years and over (6%)
- 2050 Projected: 18–44 years (34%), 45–64 years (22%), Under 18 years (9%), 75 years and over (11%)

US Dept of Health and Human Services, 2009 Annual Report
Transportation & Public Health

Traffic Safety + Personal Health
Annual US Traffic Fatalities

Source: NHTSA, FHWA
US Traffic Fatality Rate/HMVM (hundred million vehicle miles)

Source: NHTSA, FHWA
US Traffic Fatality Rate/HMVM

(hundred million vehicle miles)

Source: NHTSA, FHWA
US Traffic Fatality Rate/HMVM

(hundred million vehicle miles)

SEAT BELT LAWS

Required: Federal – Jan 1, 1968
Use – New York – 1984
Use – 2009 – all but Vermont

Source: NHTSA, FHWA
US Traffic Fatality Rate/HMVM

(hundred million vehicle miles)

Source: NHTSA, FHWA
“Changes in highway infrastructure between 1984 and 1997 have not reduced traffic fatalities and injuries, and have even had the effect of increasing total fatalities and injuries.

Other factors, primarily changes in the demographic age mix of the population, increased seat belt usage, and improvements in medical technology are responsible for the downward trend in fatal accidents.”

Noland, R. B. 2001, Transportation Research Board
Traffic accidents are the leading cause of unintentional injury death in children age 1 - 4

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Motor vehicle accidents</td>
<td>31%</td>
</tr>
<tr>
<td>Drowning</td>
<td>27%</td>
</tr>
<tr>
<td>Fires &amp; burns</td>
<td>14%</td>
</tr>
<tr>
<td>Falls</td>
<td>2%</td>
</tr>
<tr>
<td>Suffocation</td>
<td>8%</td>
</tr>
<tr>
<td>Poisoning</td>
<td>2%</td>
</tr>
<tr>
<td>Other injuries</td>
<td>15%</td>
</tr>
</tbody>
</table>

Source: CDC National Vital Statistics System, 2000 - 2005
Traffic accidents are the leading cause of unintentional injury death in children age 5 – 9

- Motor vehicle accidents: 53%
- Drowning: 13%
- Fires & burns: 13%
- Falls: 1%
- Suffocation: 4%
- Poisoning: 1%
- Other injuries: 15%

Source: CDC National Vital Statistics System, 2000 - 2005
Traffic accidents are the leading cause of unintentional injury death in children age 10 – 14

Motor vehicle accidents: 58%
Drowning: 10%
Fires & burns: 6%
Falls: 2%
Suffocation: 4%
Poisoning: 2%
Other injuries: 18%

Source: CDC National Vital Statistics System, 2000 - 2005
Traffic accidents are the leading cause of unintentional injury death in children age 15 – 19

- Motor vehicle accidents: 76%
- Drowning: 5%
- Fires & burns: 1%
- Falls: 1%
- Suffocation: 4%
- Poisoning: 7%
- Other injuries: 9%

Source: CDC National Vital Statistics System, 2000 - 2005
Five things that worry parents the most:

- Kidnapping
- School snipers
- Terrorists
- Dangerous strangers
- Drugs

Five things most likely to cause injury or death (children < 18):  

- Car accidents
- Homicide*
- Child abuse
- Suicide
- Drowning

* someone they know
The most dangerous thing your child does, statistically, is get into a car with you.
2008 Fatalities

- Vehicle Occupants: 64%
- Motorcyclists: 18%
- Pedestrians: 15%
- Bicyclists: 2%
- Other: 1%
US Injury Rate: Pedestrians Hit by Motor Vehicles

(rate/100,000 population)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>&lt; 5</th>
<th>5 - 9</th>
<th>10 - 15</th>
<th>16 - 20</th>
<th>21 - 24</th>
<th>25 - 34</th>
<th>35 - 44</th>
<th>45 - 54</th>
<th>55 - 64</th>
<th>65 - 74</th>
<th>75 - 85</th>
<th>85+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>19</td>
<td>39</td>
<td>42</td>
<td>34</td>
<td>20</td>
<td>16</td>
<td>24</td>
<td>19</td>
<td>17</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: NHTSA, 2008
US Fatality Rate: Pedestrians Hit by Motor Vehicles

(rate/100,000 population)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Fatality Rate</th>
</tr>
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<tbody>
<tr>
<td>&lt; 5</td>
<td>0.45</td>
</tr>
<tr>
<td>5 - 9</td>
<td>0.39</td>
</tr>
<tr>
<td>10 - 15</td>
<td>0.59</td>
</tr>
<tr>
<td>16 - 20</td>
<td>1.33</td>
</tr>
<tr>
<td>21 - 24</td>
<td>1.61</td>
</tr>
<tr>
<td>25 - 34</td>
<td>1.42</td>
</tr>
<tr>
<td>35 - 44</td>
<td>1.58</td>
</tr>
<tr>
<td>45 - 54</td>
<td>1.97</td>
</tr>
<tr>
<td>55 - 64</td>
<td>1.62</td>
</tr>
<tr>
<td>65 - 74</td>
<td>1.79</td>
</tr>
<tr>
<td>75 - 85</td>
<td>2.28</td>
</tr>
<tr>
<td>85 +</td>
<td>2.55</td>
</tr>
</tbody>
</table>

Source: NHTSA, 2008
Honolulu
pedestrian survival rates & vehicle speed

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>% Survive</th>
<th>% Die</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>30</td>
<td>55%</td>
<td>45%</td>
</tr>
<tr>
<td>40</td>
<td>15%</td>
<td>85%</td>
</tr>
</tbody>
</table>
Pre-1950 Traffic Safety Model

Based on and Revised from Ewing and Dumbaugh, Journal of Planning Literature, Vol. 23, No. 4
Traditional Traffic Safety Model

- Roadway Design
- Traffic Volume
- Traffic Conflicts
- Traffic Speed
- Crash Frequency
- Crash Severity
- Driver Behavior

Based on and Revised from Ewing and Dumbaugh, Journal of Planning Literature, Vol. 23, No. 4
Context-Based Traffic Safety Model

Based on and Revised from Ewing and Dumbaugh, Journal of Planning Literature, Vol. 23, No. 4
Colonial Drive: Comparison section

Colonial Drive: Livable section
Street/Urban Design

Mid-Block Crashes/100 MVMT

<table>
<thead>
<tr>
<th></th>
<th>“Livable” Section</th>
<th>Comparison Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>95</td>
<td>102</td>
</tr>
<tr>
<td>Injury</td>
<td>54</td>
<td>69</td>
</tr>
<tr>
<td>Fatality</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Eric Dumbaugh, JAPA, Summer 2005, Vol. 71, No. 3
Speed
The U-Shaped Curve

Source: FHWA-RD-98-154
Crash Severity

Source: FHWA-RD-98-154
Changing Speed Limits

Source: FHWA-RD-98-154
Higher Speeds

- Increase:
  - the rate of injury accidents
  - the severity of accidents
  - the fatality rate
  - the pedestrian fatality rate
Cross Section
Number of Lanes

Collision Rates – Medium Density – Controlling for ADT

![Bar chart showing collision rates for different numbers of lanes and land uses.](chart)

- **Residential Land Uses**
  - 2 lane: 110
  - 3 lane TWLTL: 180
  - 4 lane undivided: 230

- **Commercial Land Uses**
  - 2 lane: 270
  - 3 lane TWLTL: 210
  - 4 lane undivided: 260

*Source: Hummer and Lewis, FHWA/NC/2000-003, NCSU*
Wider, less congested streets are not safer.
Accident Rates + Access Management

<table>
<thead>
<tr>
<th>Intersections/Corridor Mile</th>
<th>Undivided</th>
<th>TWLTL</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>3.8</td>
<td>3.4</td>
<td>2.9</td>
</tr>
<tr>
<td>20 – 40</td>
<td>7.3</td>
<td>5.9</td>
<td>5.1</td>
</tr>
<tr>
<td>40 – 60</td>
<td>9.4</td>
<td>7.9</td>
<td>6.8</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>10.6</td>
<td>9.2</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Source: Hummer and Lewis, FHWA/NC/2000-003, NCSU
Undivided multi-lane streets and especially streets with two-way left turn lanes are more dangerous than streets with medians.
Public health is becoming a huge factor in our economy and is directly affected by our transportation choices.
Livable Places
Filter: Triple Bottom Line

- Economy
- Environment
- Equity
Single Purpose Spending

Transportation

Housing

Public Health

Environment

Energy
Integrated, Strategic Investment

Public Health

Housing

Transportation

Energy

Environment
Interagency Partnership for Livable Communities
“Livable Places”

- Affordable
- Walkable
- Connected
- Complete
Affordable
Household Income: $35K - $50K

Urban

Other
63%

H + T
37%

Data: Center for Neighborhood Technology
Household Income: $35K - $50K

Suburban

Other 51%

H + T 49%

Data: Center for Neighborhood Technology
Household Income: $35K - $50K

Rural

Other
49%

H + T
51%

Data: Center for Neighborhood Technology
Household Income: $20K - $35K

Urban

Other 46%

H + T 54%

Data: Center for Neighborhood Technology
Household Income: $20K - $35K

Suburban

Other
34%

H + T
66%

Data: Center for Neighborhood Technology
Household Income: $20K - $35K

Rural

- Other 30%
- H + T 70%

Data: Center for Neighborhood Technology
Gas @ $5.20/gallon?
Household Income: $35K - $50K

Suburban

Other 51%

H + T 49%

@ $2.60

Data: Center for Neighborhood Technology
Household Income: $35K - $50K

Suburban

Other 47%

H + T 53%

@ $5.20

Data: Center for Neighborhood Technology
Household Income: $20K - $35K

Suburban

Other 34%

H + T 66%

@ $2.60

Data: Center for Neighborhood Technology
Household Income: $20K - $35K

Suburban

Other: 27%

H + T: 73%

@ $5.20

Data: Center for Neighborhood Technology
Walkable
76 million seniors

78 million millennials

two largest generations, same housing market:
*mixed-use, transit-served, walkable neighborhoods*
Boulder
Connected
Windsor, CO – Old Town
Windsor, CO – after 1990
optimum block size for efficient traffic flow

330’ to 528’
common connectivity standards

- intersections/square mile (min 200)
- maximum block perimeter (1400’ – 1800’)
- block length (330’ – 528’)
- links/nodes
good connectivity also expands the range of walking trips, increasing pedestrian activity
walk propensity

utilitarian trips

- 100% 100% 100%
- 50% 50% 50%
- 0% 0% 0%

Min 5 Min 7 Min 10 Min 15 Min 20 Min
walk distances @ 250 fpm

- 5,000’ in 20 min
- 3,750’ in 15 min
- 2,500’ in 10 min
- 1,250’ in 5 min

- ¼ mile
- ½ mile
- 1 mile
path index

shortest feasible route on streets & trails

straight line distance (as the crow flies)
5 – 7 minute walk

- home
- active living
- third places
- convenience retail
path index: 1.4

- home
- 1. active living
- 2. third places
- 3. convenience retail

5 – 7 minute walk

¼ mile
5 – 7 minute walk

path index: 4.5

1. active living
2. third places
3. convenience retail
Complete
Spatial Relationships

Community → Region

Neighborhood → Community

Home
Average Trip Lengths

- Walk: 0.73
- Bicycle: 2.13
- Streetcar: 5.41
- Local Bus: 6.44
- Auto: 10.29

(2009 NHTS)
Trip Length – All Trips

1 mile: 28%
2 miles: 40%
3 miles: 50%

(2009 NHTS)
Trip Length – Driving Trips

1 mile: 20%
2 miles: 33%
3 miles: 43%

(2009 NHTS)
the neighborhood

- ¼ mile radius
- 160 – 200 acres

Graphic: Doug Farr, Sustainable Urbanism
the complete neighborhood

- schools
- local retail
- services
- parks
- diverse housing
- transit

Graphic: Doug Farr, Sustainable Urbanism
the complete neighborhood

- walkable
- mixed-use
- transit-served

Graphic: Doug Farr, Sustainable Urbanism
Household Needs

1. active living
2. third places
3. convenience retail
4. provisions & services
5. family
6. shopping
7. medical
8. cultural
<table>
<thead>
<tr>
<th>destinations</th>
<th>daily</th>
<th>weekly</th>
<th>monthly</th>
</tr>
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<tbody>
<tr>
<td>1. active living</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. third places</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. convenience</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. provisions</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5. family</td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>6. shopping</td>
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<td>X</td>
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</tr>
<tr>
<td>7. medical</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>8. cultural</td>
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## Destinations

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
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<td>1. Active Living</td>
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<td>8. Cultural</td>
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**Note:** Should be within walking distance
## Destinations

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Portland “20-minute neighborhood”
Livable places are affordable, walkable, connected and complete. They are the market for new development.
wrap up
3 Keys

Transportation and the Future
Energy
Petroleum Dependency
BOTTOM LINE:

We are entering the Post Petroleum Era, ready or not.
2

Public Health
Transportation & Public Health

Traffic Safety + Personal Health
Public health is becoming a huge factor in our economy and is directly affected by our transportation choices.
Livable Places
Livable places are affordable, walkable, connected and complete. They are the market for new development.
It’s Not
Your Father’s Transportation Program
Climate Change
Recession
Public Health
Congestion
Sustainability
Smart Growth
Energy
Safety
Opportunity!
Thank You

www.charlier.org