

# The Future of Mobility

Tenfold Productivity Increase in Transport

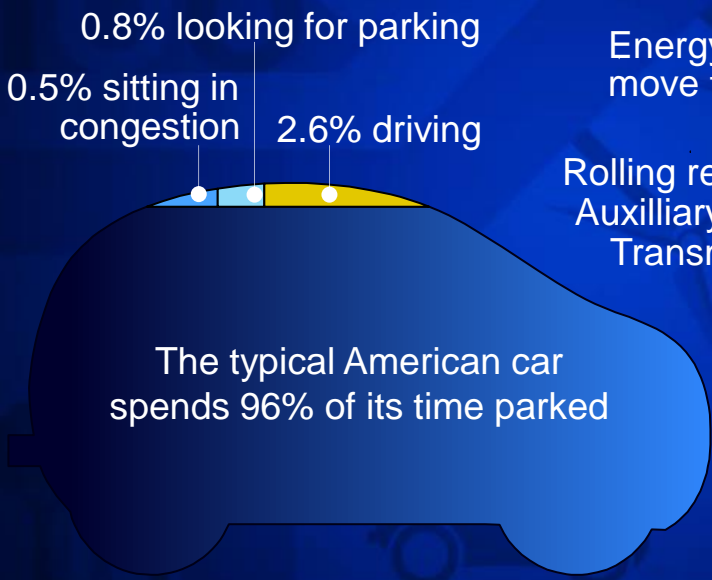
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Prof. Stefan Heck  
Stanford University

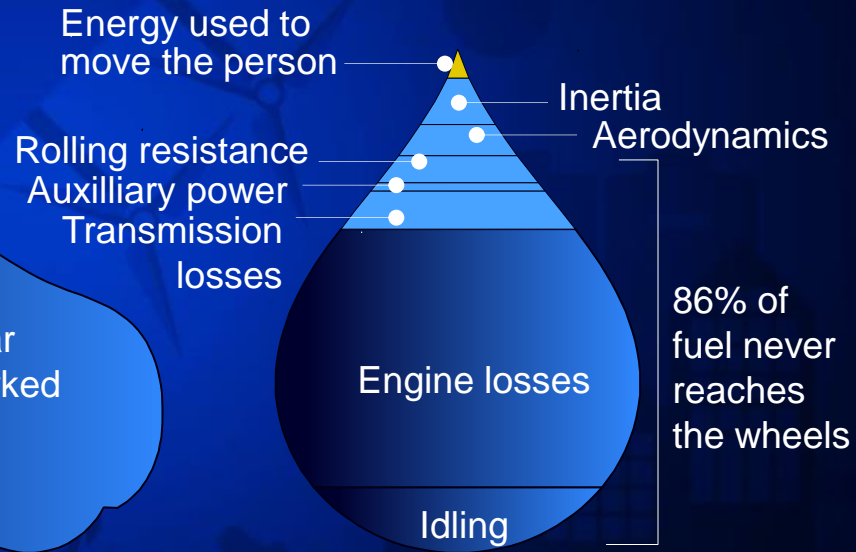
August 3, 2015

# Our transport system today is extremely inefficient

Productive use

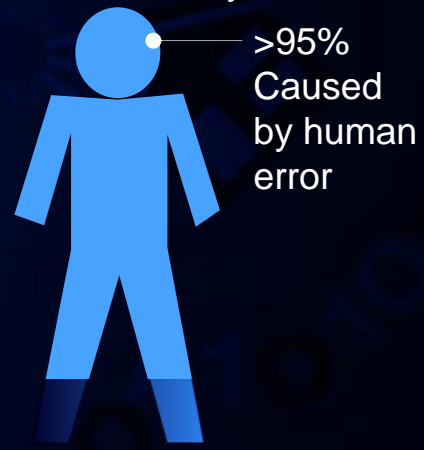


## Energy flow through a combustion engine

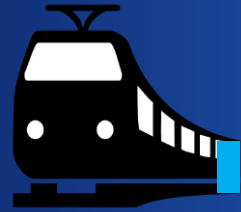
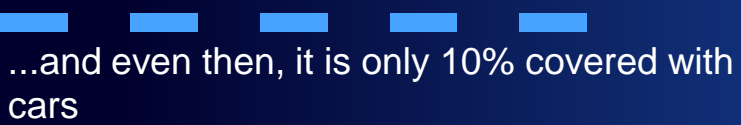


## Deaths per year from transport

More than 33,000 in US  
\$300B annually in cost



An American road reaches peak throughput only 5% of the time...



US Transit - 5% of trips, 77% on-time vs 90%+ OECD, frequencies of 20-60 min in most cities  
Starved infrastructure: 2.4% of GDP on transport infrastructure (vs. 5% Europe, 9% China, 5%+ US before 1960) and <25% on transit

# Where we live significantly shapes our transport needs

## Impact of urban form and transport infrastructure on CO<sub>2</sub> emissions: Atlanta vs Barcelona

### ATLANTA

Atlanta's built-up area



Population: 5.25 million  
Urban area: 4,280 km<sup>2</sup>  
Carbon emissions: 7.5 tonnes CO<sub>2</sub> per hectare per annum from public and private transport

### BARCELONA

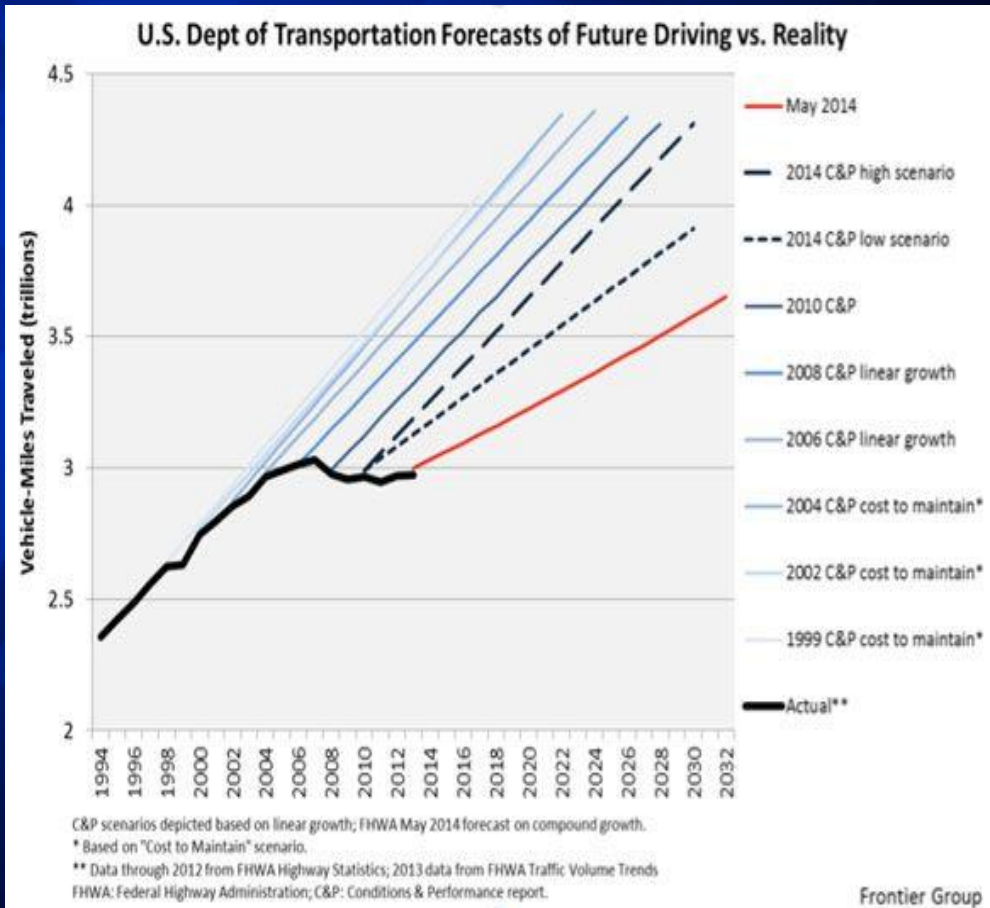
Barcelona's built-up area



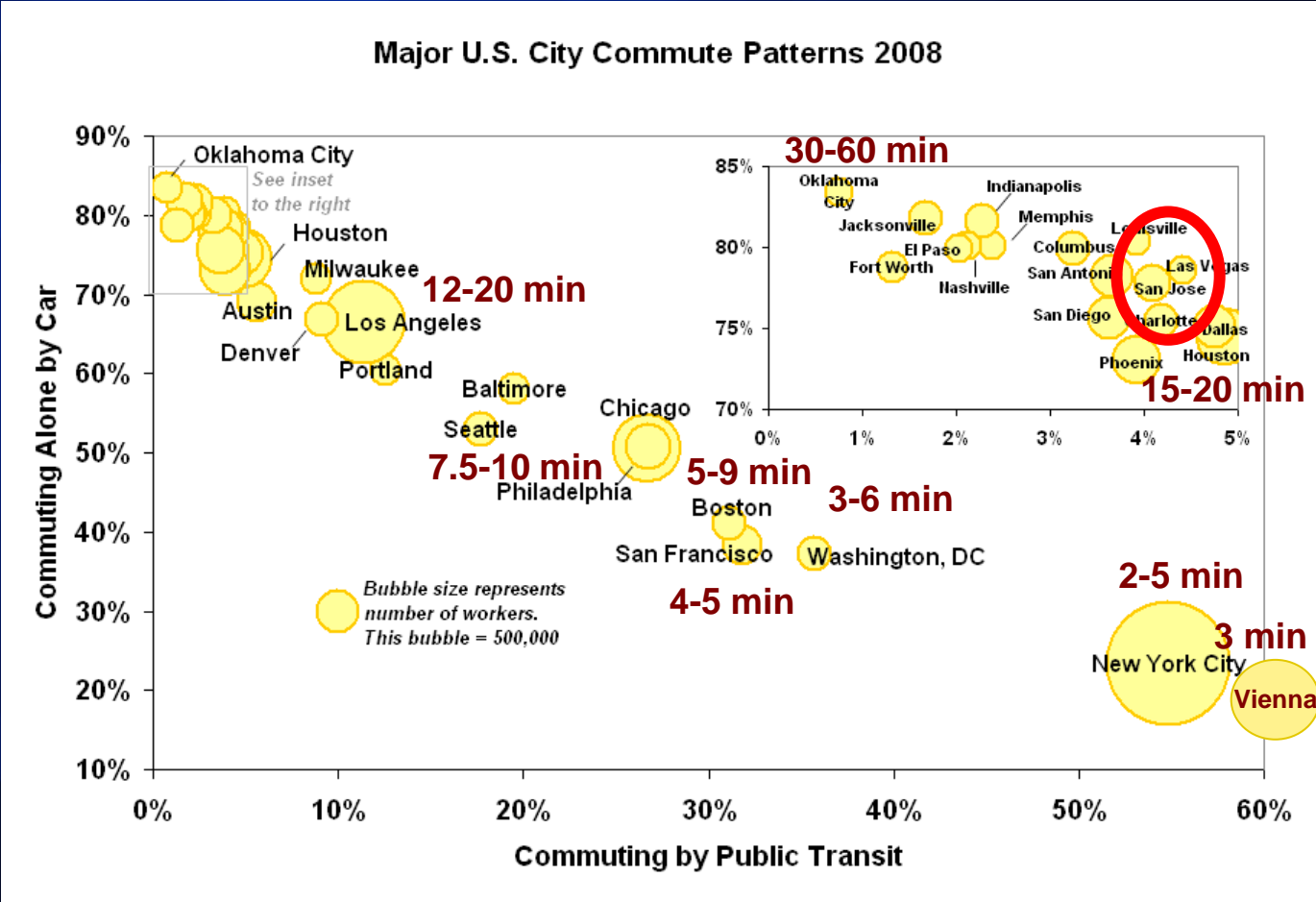
Population: 5.33 million  
Urban area: 162 km<sup>2</sup>  
Carbon emissions: 0.7 tonnes CO<sub>2</sub> per hectare per annum from public and private transport

Source: Bertaud and Richardson, 2004

# Consumer preferences have shifted and planners haven't adjusted

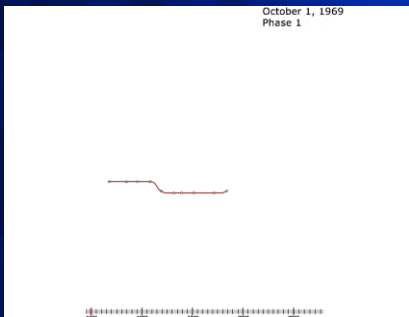


# Frequency, travel times, and local density matter to transit success

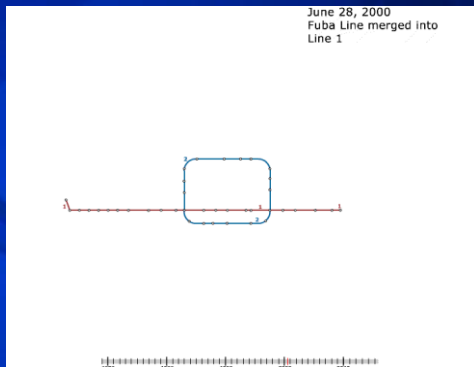


# Routes, stops, and headway for success

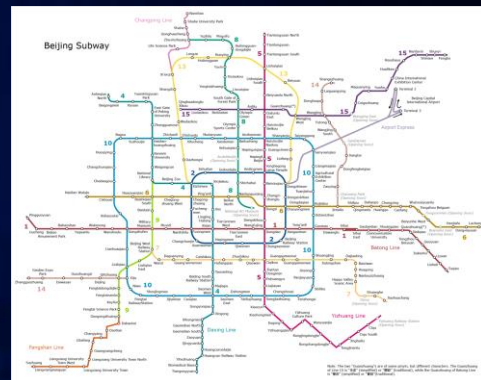
1969  
20K riders  
15 min headway



2000  
1.2M riders



Today  
9.3M riders  
2 min 5 sec headway



Stations 1 mile apart

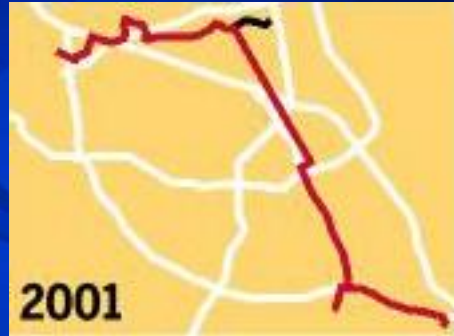


# Routes, stops, and headway

1987  
137K system  
15 min headway



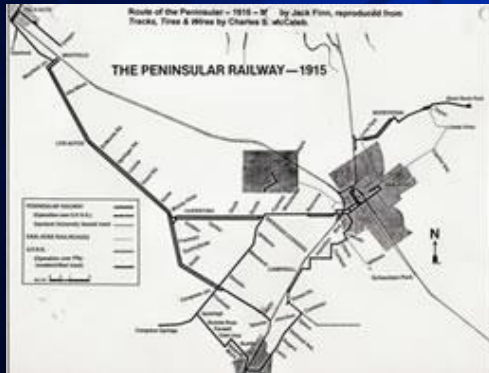
2000



Today  
30K riders (119K system)  
15 min

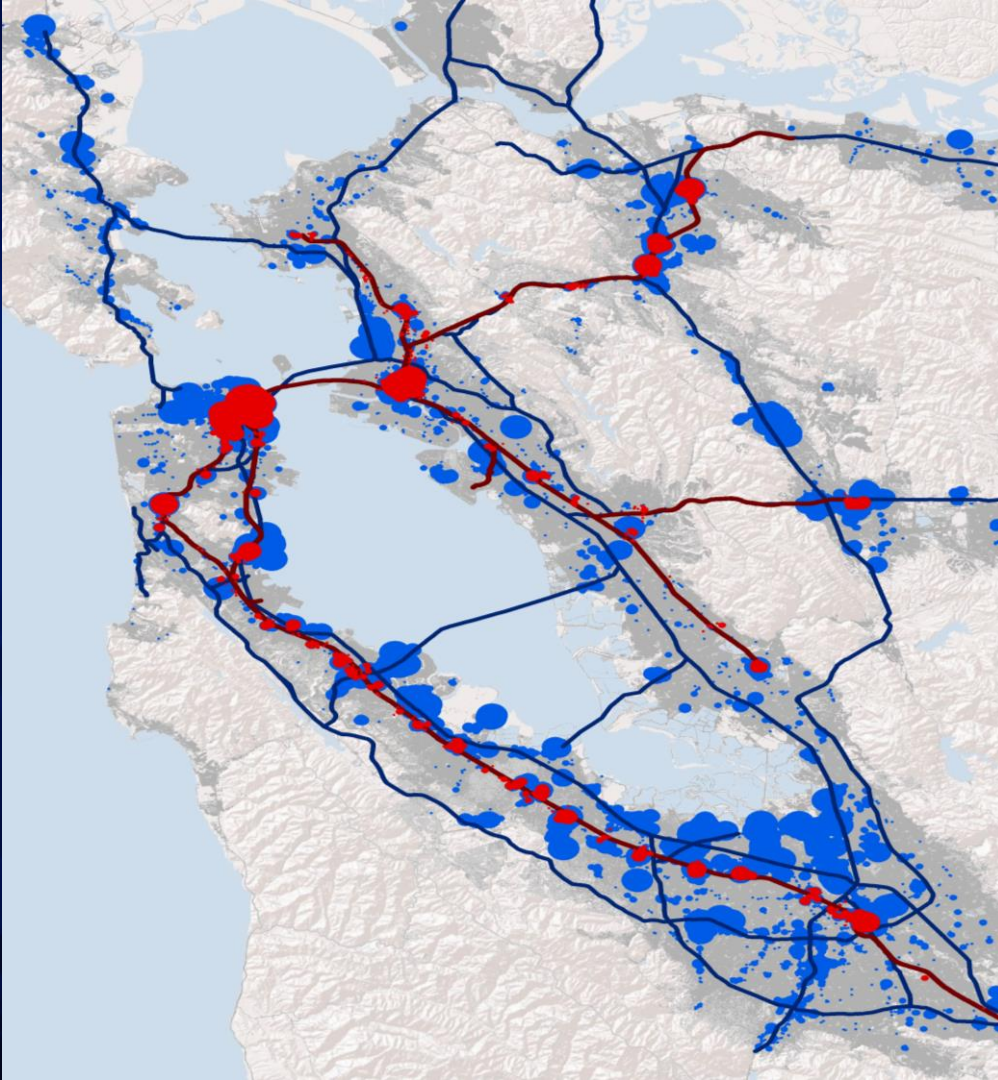


1920  
60 min headway



Stations 0.6 miles apart



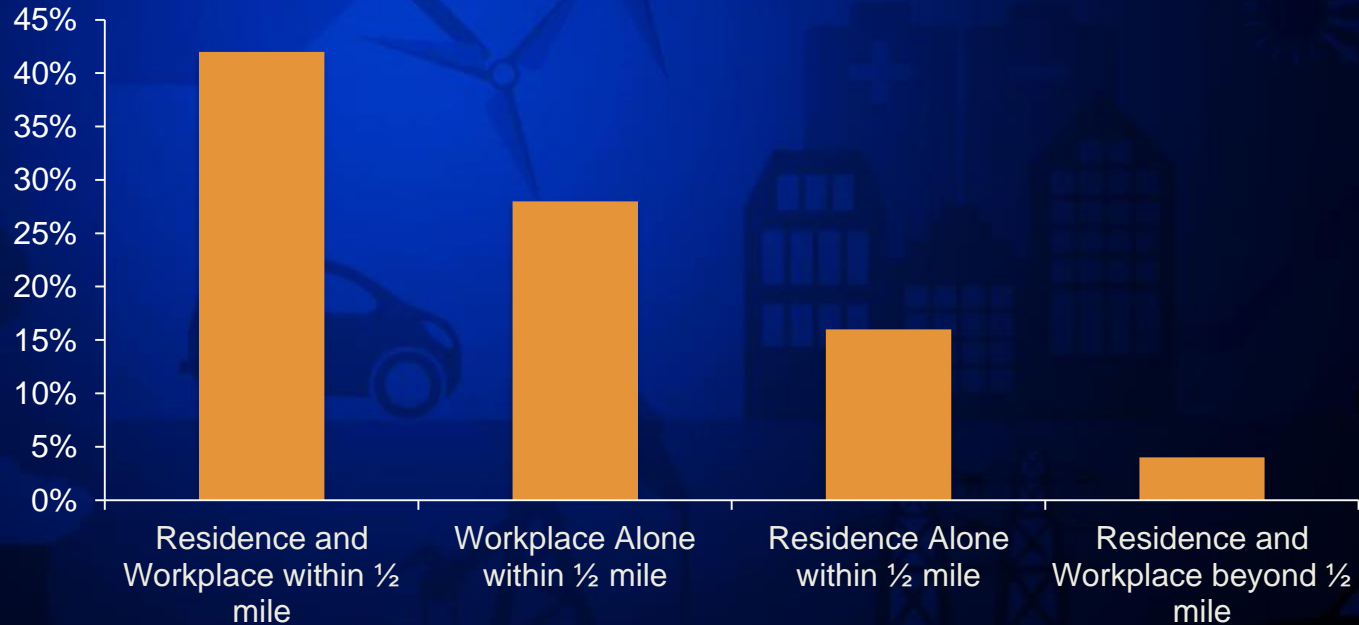


**We have  
put jobs  
near  
freeways,  
not transit,  
creating a  
last mile  
problem**



# Jobs near transit are more important than homes in getting people to use transit

Transit commute mode share, depending on proximity to regional rail (including ferry)



Source: SPUR

# The Future is Multi-Modal Transport

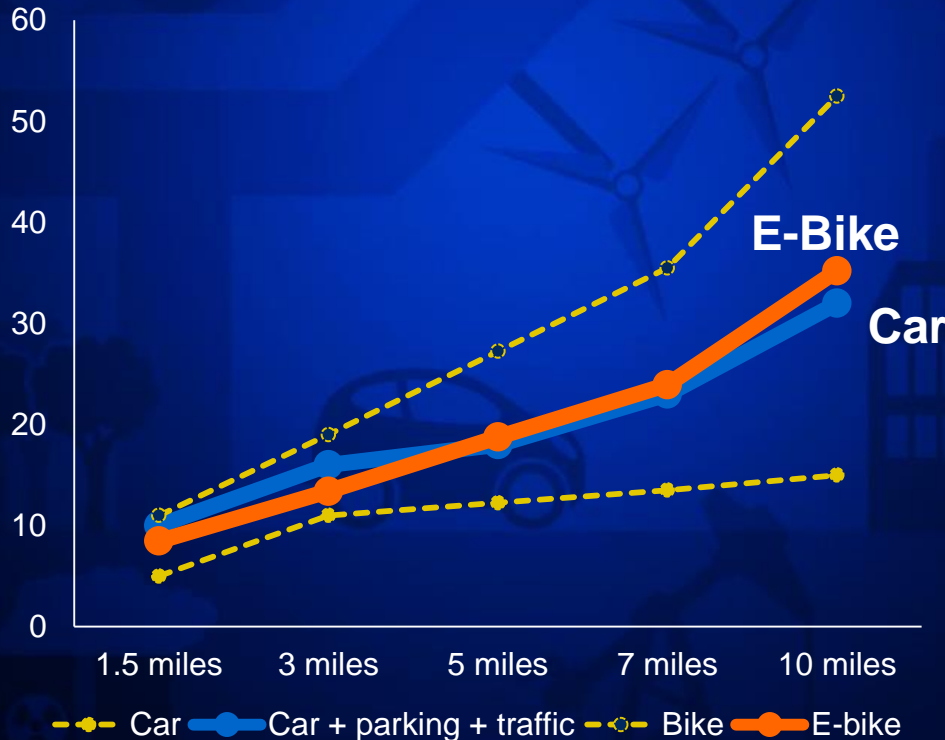


The collage displays four mobile app screenshots:

- Subway Stations:** Shows a map of a subway station area with a blue circle highlighting a specific location. A green bar at the top contains icons for subway, bus, and bicycle. A bottom bar shows "Clinton - Washington Aves" with a "9 min walk" indicator.
- Citymapper New York:** Shows a map with a blue location pin. A green bar at the top contains icons for subway, bus, and bicycle. Below the map are buttons for "Subway Map", "Line Status", and "Favorites". A search bar contains "Get Me Somewhere". Other buttons include "Get Me Home" and "Get Me To Work". A "My Places" section is visible at the bottom.
- Results:** Shows a route summary with "Start" at Canal St, 10002 and "End" at Willoughby Ave, 11206. It includes a "Leaving Now" status and a "Set Arrival Time" button. Weather information shows "88°F • Partly Cloudy at destination". Three options are listed: walking (69 min, 283 cal), cycling (~23 min, 102 cal), and driving (16 min, \$13-17). Suggested routes include "F • G" (32 min) and "M" (39 min). A "More: Bus Only" section lists "B39 • B44" (38 min).
- Bike Share Stations:** Shows a map of bike share stations with red and blue icons. A green bar at the top contains icons for subway, bus, and bicycle. A bottom bar shows "5 Forsyth St & Broome St".

# E-bikes beat cars under 10 mile range

## Commute time by distance



## Annual costs, USD 5 miles example

Car owner - \$7,194

E-bike owner - \$875  
\$2,387 Uber (backup, 40  
days weekdays +  
55 days of weekend use)  
TOTAL: \$3,263 total

# Sharing is “in the money” for low mileage customers

Annual cost of mobility  
\$/vehicle equivalent

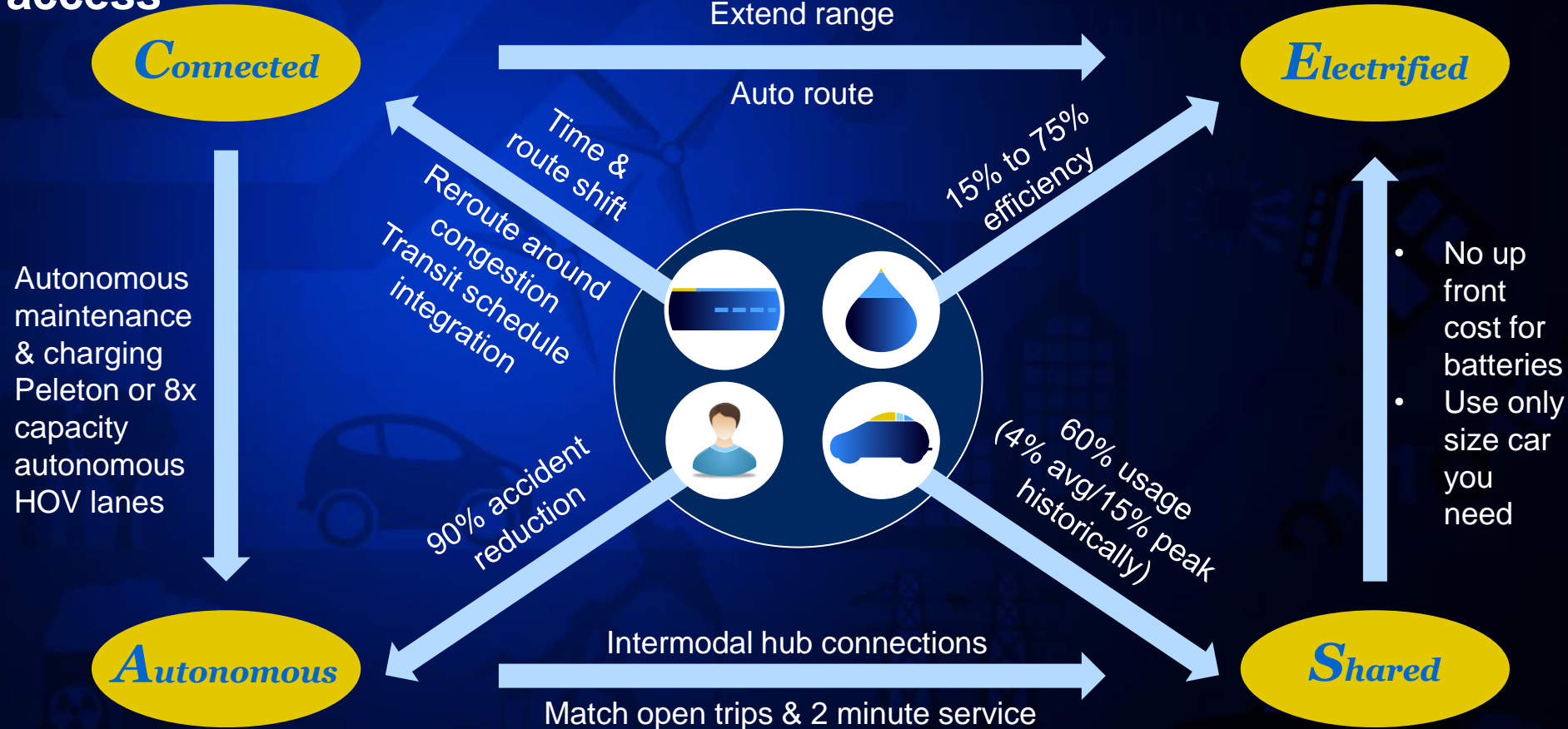
BAY AREA



Percentage of US drivers



# ACES: from 67-120 cents/mile today to 9 cents/mile and universal access



# Monday Morning for a City

1. Planning – integrated convenience: merge road and transit departments, get rid of linear forecasts (VMT, 8x capacity), factor in learning curves, plan from user convenience view and integrated commute routes across jurisdictions
2. Land Use - share: allow growth near existing transit (height limits, multi-use with ground level retail, integrate sharing systems)
3. Transit - frequent: vehicle headway/frequency to 5 minutes, integrate 2 wheelers, electrify, get rid of geo coverage as a metric
4. Parking - turnover: charge for parking and if possible congestion, parking any legal spot for shared cars (monthly rate bundled into hourly cost)
5. Data - public: make all data public for intermodal mobility as a service to emerge, mandate integrated payment option via mobile phone - any app can access
6. New models experiment:
  - muni finance for shared fleets: cars, ebikes, scooters
  - permit new business models but require insurance
  - pilot shared autonomy