

Driverless Vehicles: Coming to a Road Near You Soon?

Florida Automated Vehicle Summit
December 15, 2014

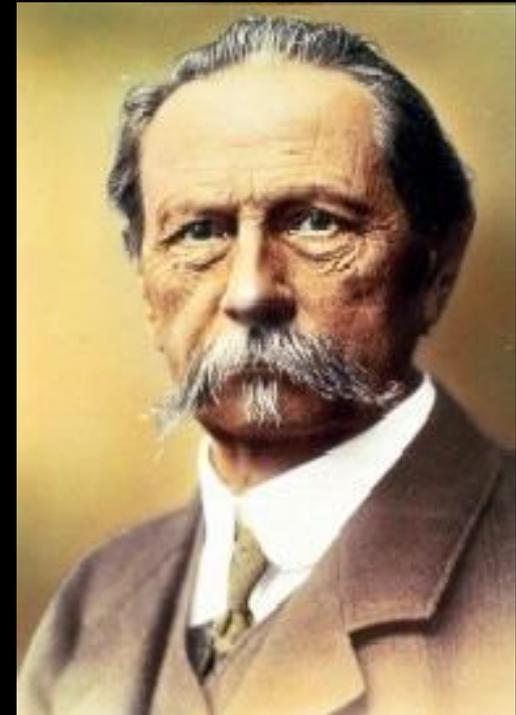
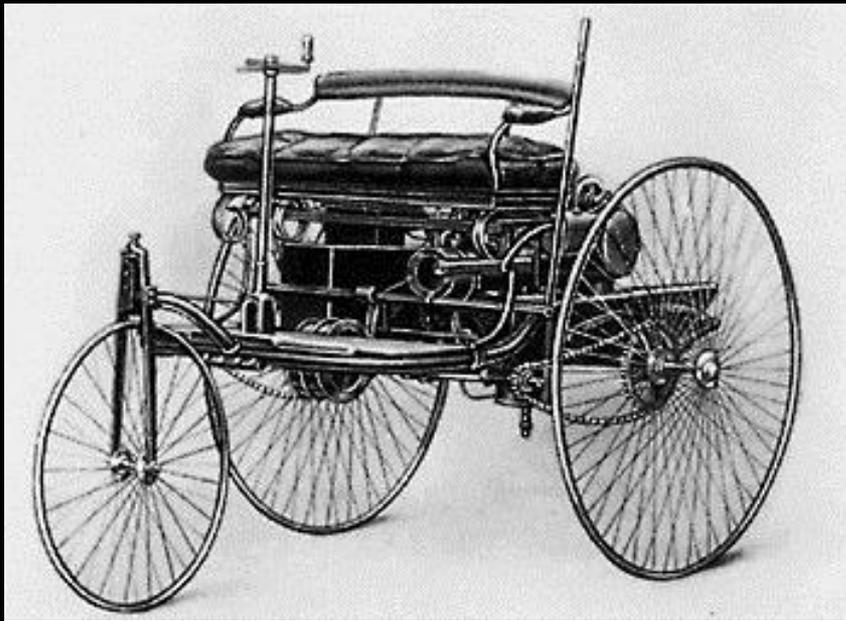
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Professor of Engineering Practice
University of Michigan

Headlines

- Transportation is ripe for transformation
- Florida is well-positioned to help lead this transformation
- Babcock Ranch, FL will be an early adopter of driverless-shared vehicles

1886: From Horses to Horsepower

Karl Benz Patented for First Gasoline
Powered Automobile



Historical Automotive “DNA”

- Mechanical Drive
- Combustion Engine
- Oil-based Fuel
- Mechanical & Hydraulic Controls
- Stand-Alone
- Personally Owned
- Human Operated
- General Purpose

~ 1 Billion
Automobiles Worldwide

Challenges

- **Safety:** 1.2 M roadway fatalities worldwide
- **Energy:** 95% dependent on oil
- **Congestion:** Traffic delays
- **Parking:** Land use, delays, cost
- **Environment:** CO2 emissions
- **Infrastructure:** Aging and costly

Transforming Mobility

Historical “DNA”

- Mechanical Drive
- Combustion Engines
- Oil-based Fuels
- Mechanical & Hydraulic
- Stand-alone
- Personally Owned
- Human Operated
- General Purpose

New “DNA”

- Electrical Drive
- Electric Motors
- Diverse Energy Sources
- Electronic & Digital
- Connected and Coordinated
- Shared
- Driverless
- Tailored

Holistic Opportunity

Connected

+

Coordinated

+

Shared

+

Driverless

+

Tailored

Connected

Coordinated

Shared

Driverless

Driverless Vehicles



DARPA Urban Challenge

Google Driverless Car



Video Highlighting Google's Driverless Vehicle Technology

Tailored

GM's EN-V Concept

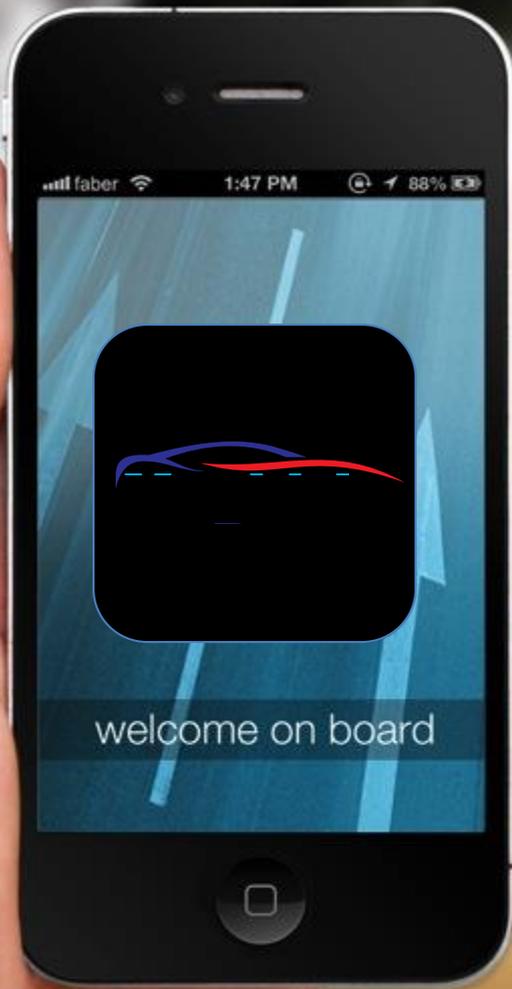


Holistic Opportunity

Connected
+
Coordinated
+
Shared
+
Driverless
+
Tailored

***Better Mobility Experiences
at Radically Lower Consumer and Societal Cost***

Video Showcasing GM's Shanghai World Expo EN-V Concept

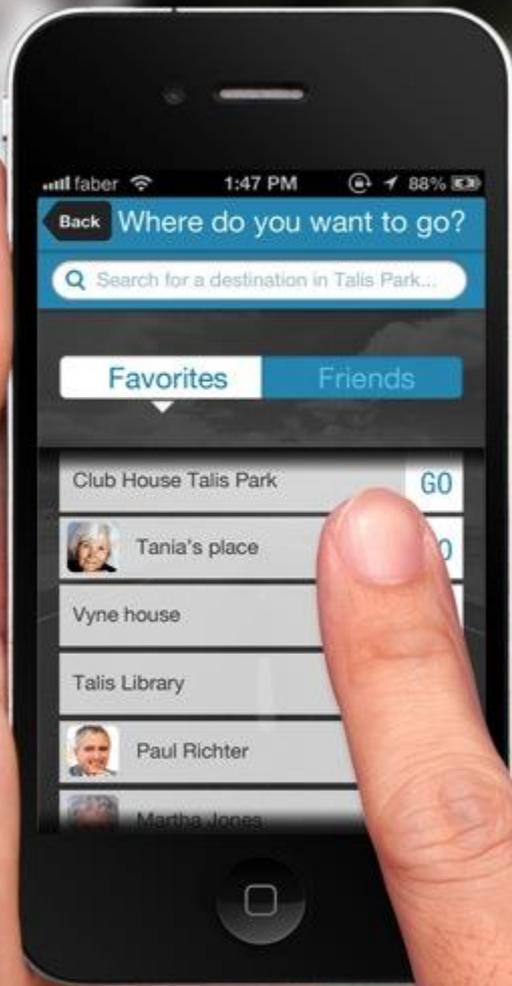


Smartphone App



Booking

Simple, one-step access



Destinations

Favorites saved

Friends located on the map

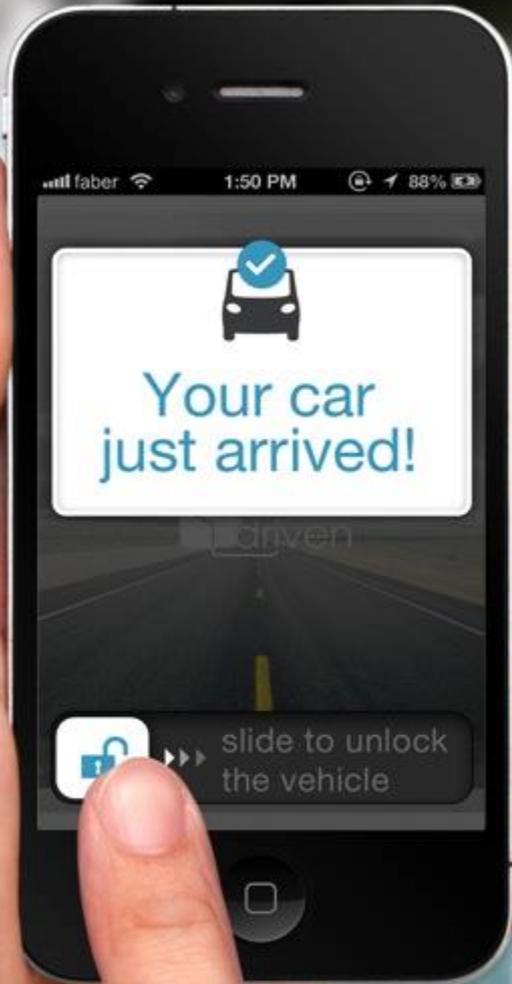


Vehicle on way

**Driverless vehicle
automatically routed to your
location**

Information

- ***estimated arrival time***
- ***remaining distance***
- ***route and status***



Pickup

Arrival alert

Secure unlock

Smartphone integrated with vehicle



Trip details

Distance

Estimated Arrival Time

Points of interest



Entertainment and services

Personalized and voice-activated

- *Local maps*
- *Music services*
- *Video services*
- *News services*
- *E-magazines and E-books*
- *E-mail and calendar*



En route

Trip status

Account summary

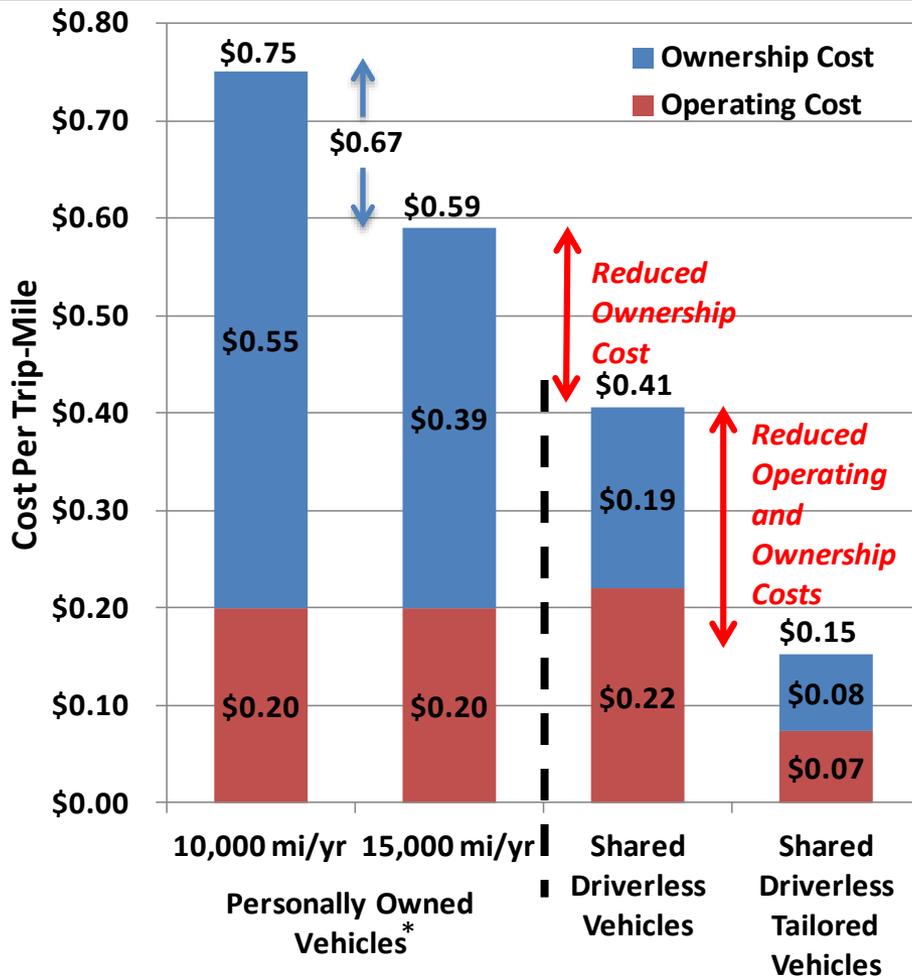
Nearby friends, venues,
restaurants, and activities

Ann Arbor, Michigan USA



- 285,000 people
- 130 square miles
- 200,000 personally owned vehicles
 - 120,000 used primarily within Ann Arbor
- 3.7 trips/vehicle per day
- Average trip
 - 8.2 miles
 - 16.3 min
 - 30 mph
 - 1.5 people
- Vehicles used an average of 60 minutes/day (4%)

Ann Arbor Results



*Source: AAA

- 18,000 shared, driverless vehicles can provide the same mobility within Ann Arbor as personally owned vehicles
 - Cost per trip-mile could be reduced by 75-80% compared to a personally owned vehicle
 - Respond to trip requests in < 2 minutes
 - Incur 0.02 empty miles per loaded mile
- Reduced parking costs and the value of time not spent driving would further increase these benefits

How Much Do You Value Your Time?

U.S. Time Value Opportunities

At 30 miles/hour...

Minimum Wage

\$7.25/hour = \$0.24/mile

Median Income

\$25/hour = \$0.83/mile

90th Percentile Income

\$50/hour = \$1.67/mile

New Business Models

Today

Sell Vehicles, Gasoline and Insurance

Tomorrow

Sell Miles, Trips and Experiences

3 trillion miles/year in U.S.

3 trillion miles/year

X

\$1.50/mile*

\$4.5 trillion/year

* \$0.67 + \$0.83 = \$1.50

3 trillion miles/year

X

\$0.01/mile

\$30 billion/year

300 billion (10% share) miles/year

X

\$0.10/mile

\$30 billion/year

Safety
&
Risk

Accelerating *1 Year* Saves...

- Over *30,000* American Lives
- Over *1 Million* Lives Worldwide

3 Questions

1. Are driverless vehicles real?
2. If so, when?
3. Does it matter?

Video of Google's Driverless Car

3 Questions

1. Are driverless vehicles real? **Yes**
2. If so, when? ***Possibly by 2018***
3. Does it matter? ***The consumer and business opportunities are compelling***

Bottom-Line

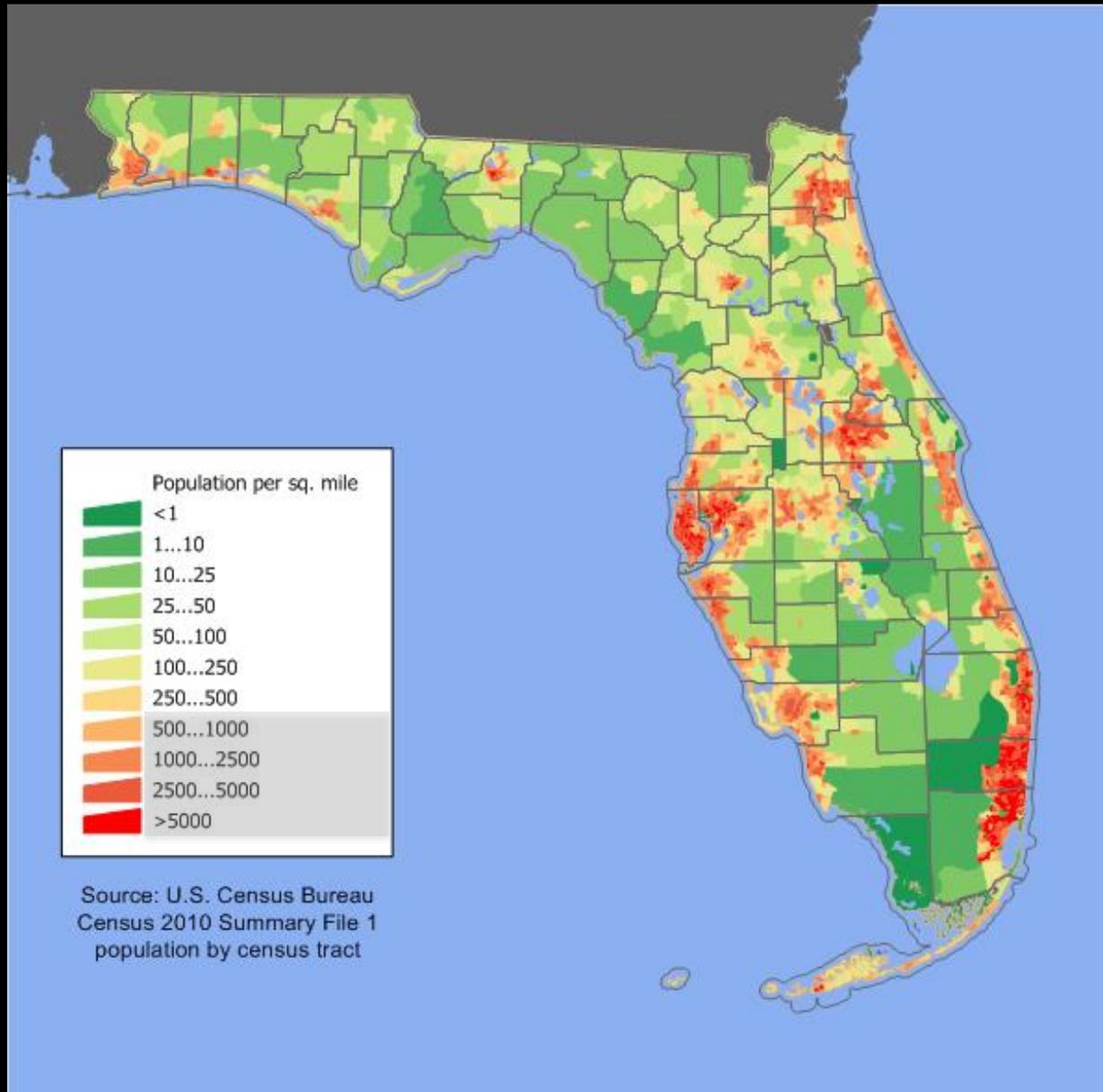
- Transportation is ***ripe for transformation***
- The convergence of ***new technology and innovative business models*** promise
 - Better mobility experiences at radically lower consumer and societal cost
 - Significant business opportunities

Florida is Well-Positioned
to Help Lead
Transportation Transformation

Florida Advantages

- Concentrated Population

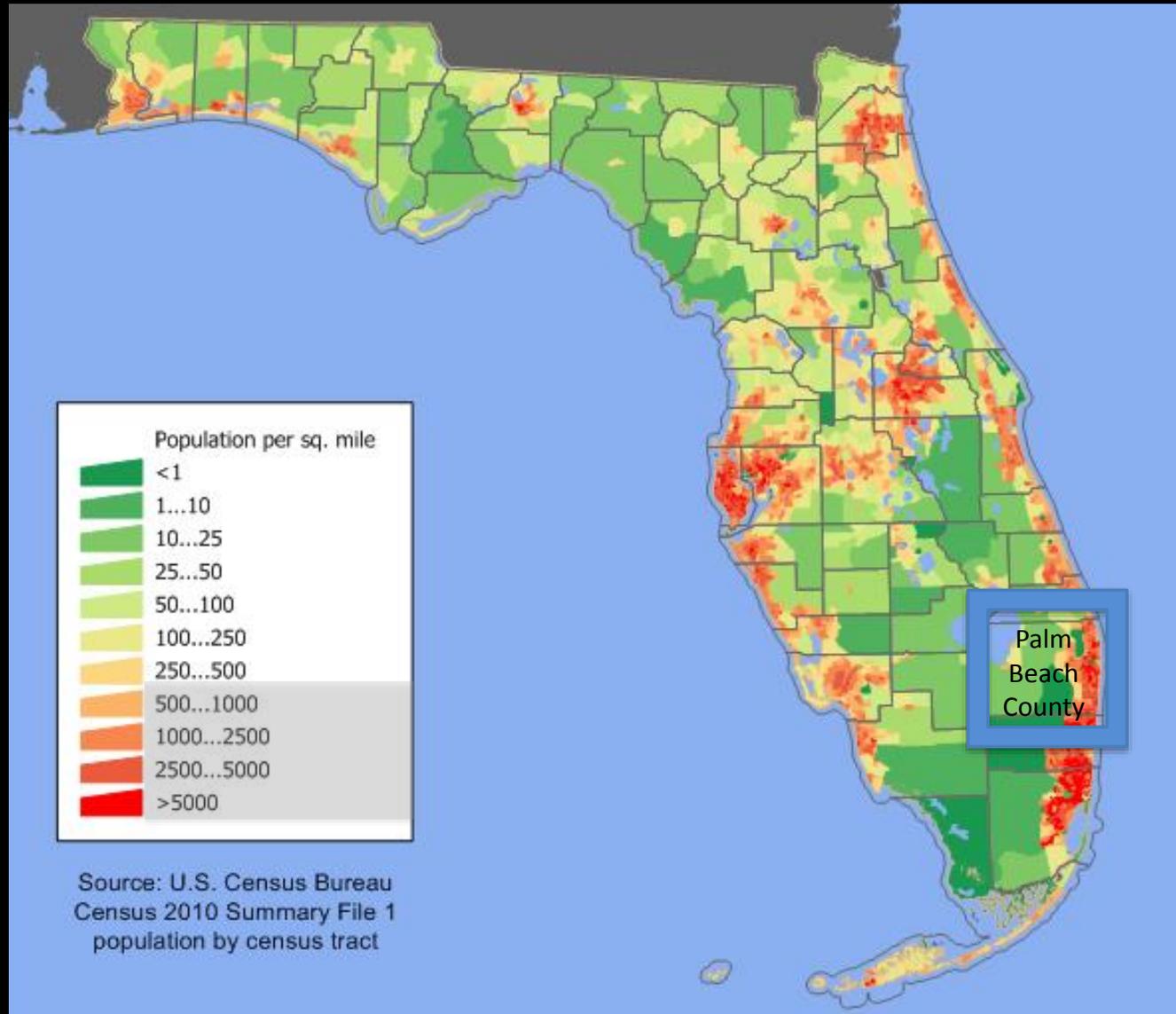
Florida Population Density



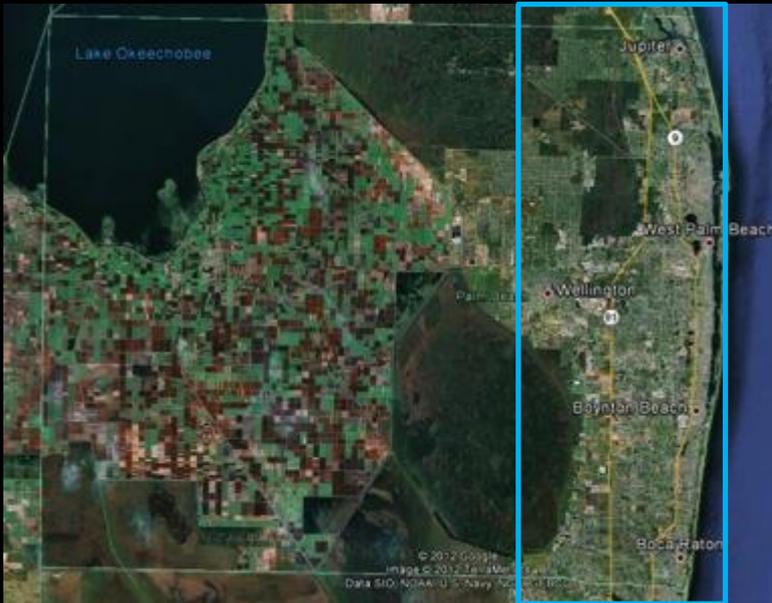
Florida Advantages

- Concentrated Population
- Distinct Communities with Excellent Demographics
- Uniform, Well-Marked Roads
- Flat Land
- Nice Weather
- Proactive State Government
 - Enabling Legislation
 - Supportive Legislators
- Substantial Tourism

Case Study: Eastern Palm Beach County



Eastern Palm Beach County

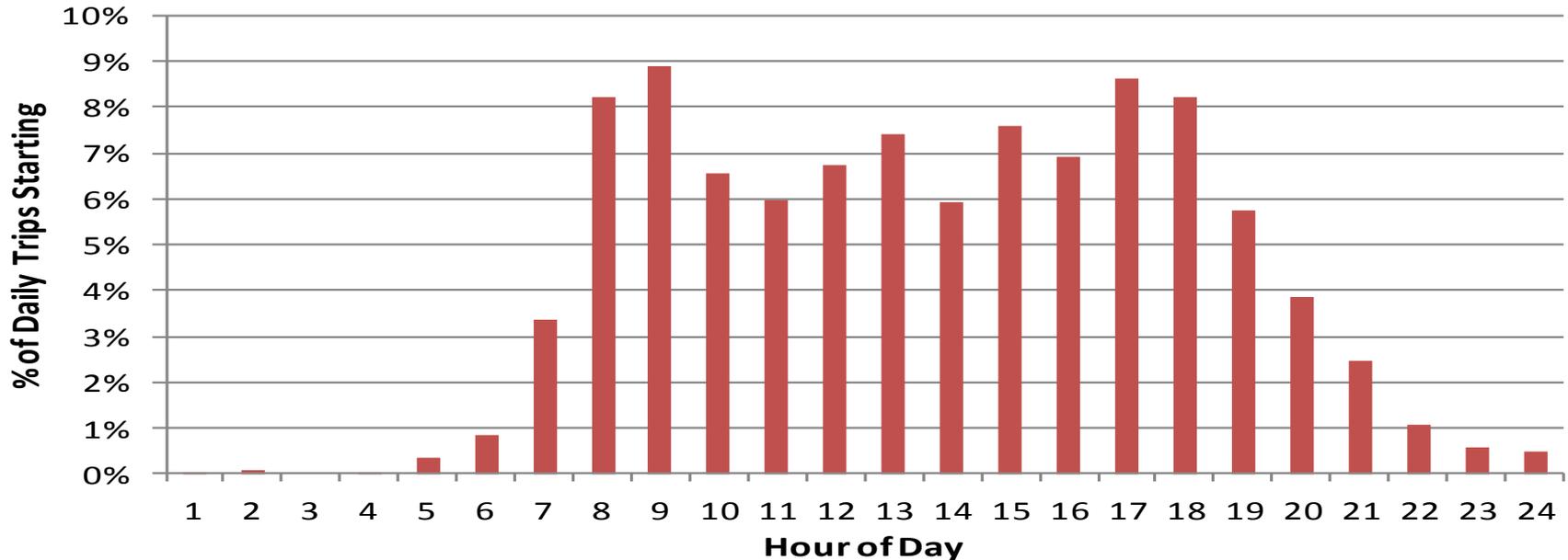


Palm Beach County

- Over 90% of Palm Beach County population lives within 15 miles of the coast
 - 400 sq. mi.
 - About 1.2 million people
- Census Tract population per sq. mi.
 - Average: 3,000
 - Range: 600 to 12,000

2009 Auto Ownership and Use in Eastern Palm Beach County

Time of Weekday Trip Starts for Vehicles Used < 100 Miles Per Day



- 840,000 personally owned vehicles
- 2.7 million vehicle-trips/day
- Average trip
 - 8.3 miles
 - 17 min
 - 30 mph
 - 1.5 people
- Vehicles parked 96% of day
- 96% of vehicles used < 100 miles per day
 - 92% of all trips
 - 72% of vehicle-miles
 - 87% start between 7 am and 7 pm
 - Average 180,000 trips/hr
 - About 7 trips/min/sq mi
 - Peak 220,000 trips/hr
 - 9% of vehicles

Results for Eastern Palm Beach County

- A 10% market share of trips requires about 8000 driverless-shared vehicles
 - Average response time of 1 minute
 - 70% average fleet utilization from 7am to 7pm (80% peak)
 - Empty miles less than 10% of loaded miles
- Out-of-pocket cost per mile (excluding parking) is 25% to 50% less than cost of owning and operating personal car

Kitson & Partners is developing
Babcock Ranch, FL
to be an early adopter of
driverless-shared vehicles

Kitson & Partners Mission

Welcome to those of you who believe, as we do, that life is too short, and the earth is too precious, for mediocrity. That people and nature are inseparable. That the world is changing fast and in need of bold new ideas. And that it takes a strong team and innovative partnerships to rise to these challenges.

We are Kitson & Partners. Game changers. Value cultivators. Creators of extraordinary environments that enrich the human experience.

Babcock Ranch





Gulf of Mexico

Atlantic Ocean



Charlotte County

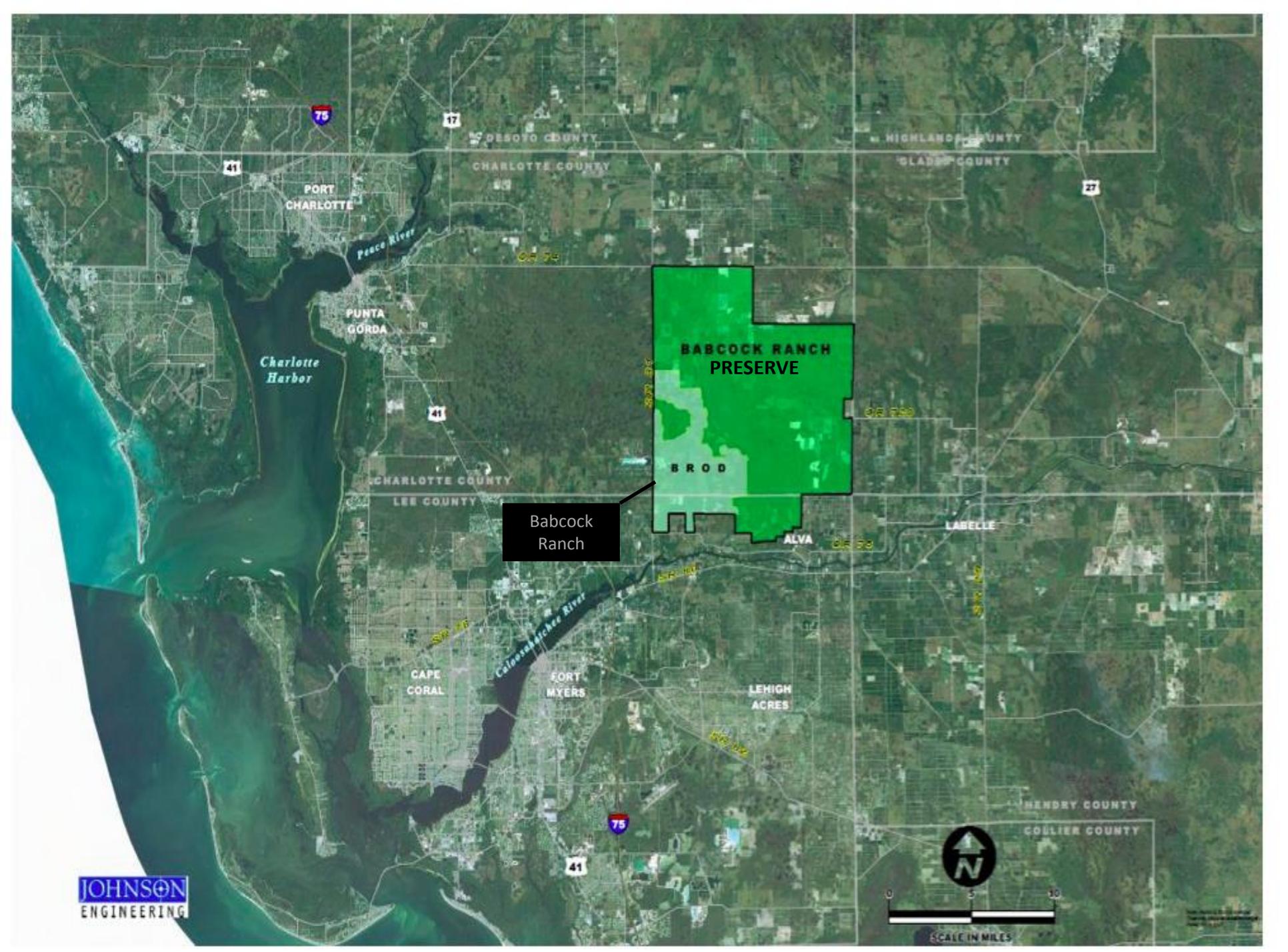
Babcock Ranch Preserve

Babcock Ranch

75

Fort Myers

Southwest Florida International Airport



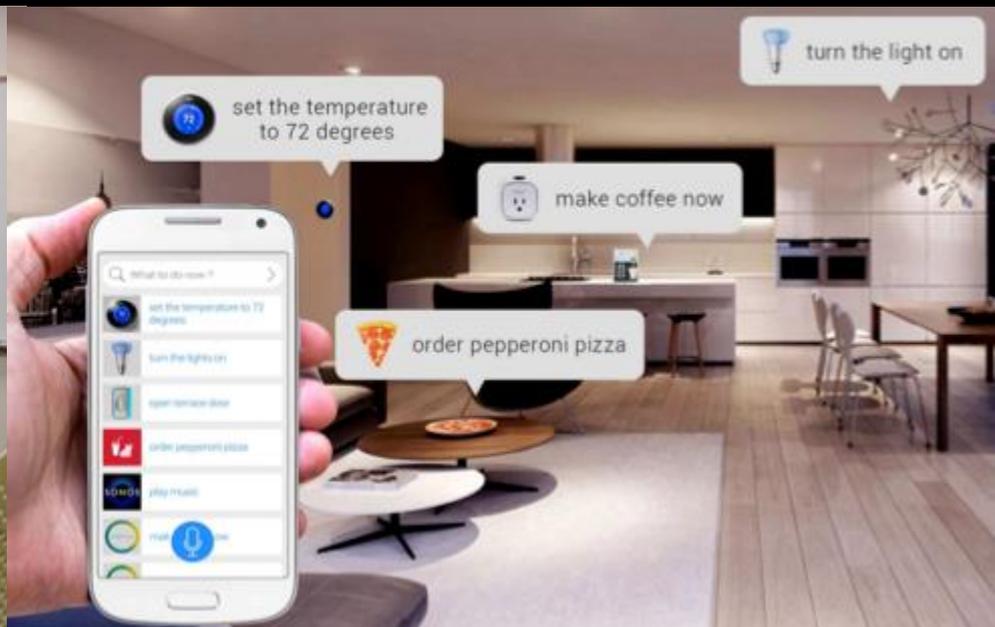
**BABCOCK RANCH
PRESERVE**

Babcock
Ranch

B R O D







































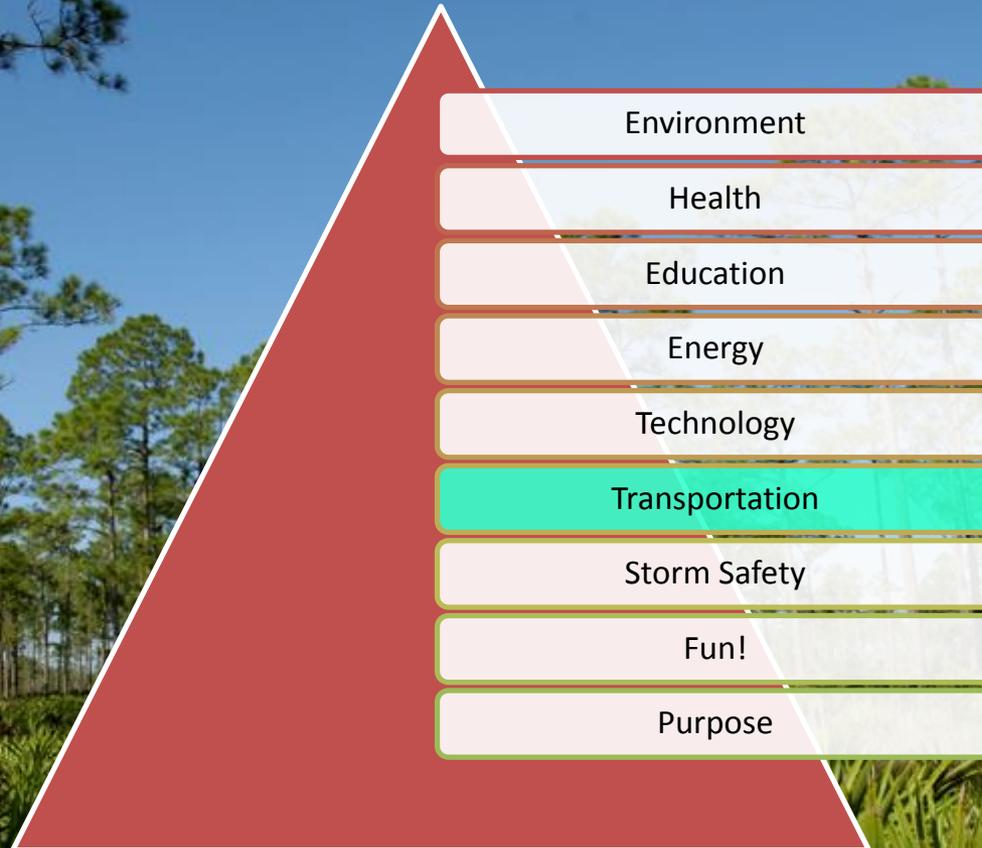








Core Community Initiatives



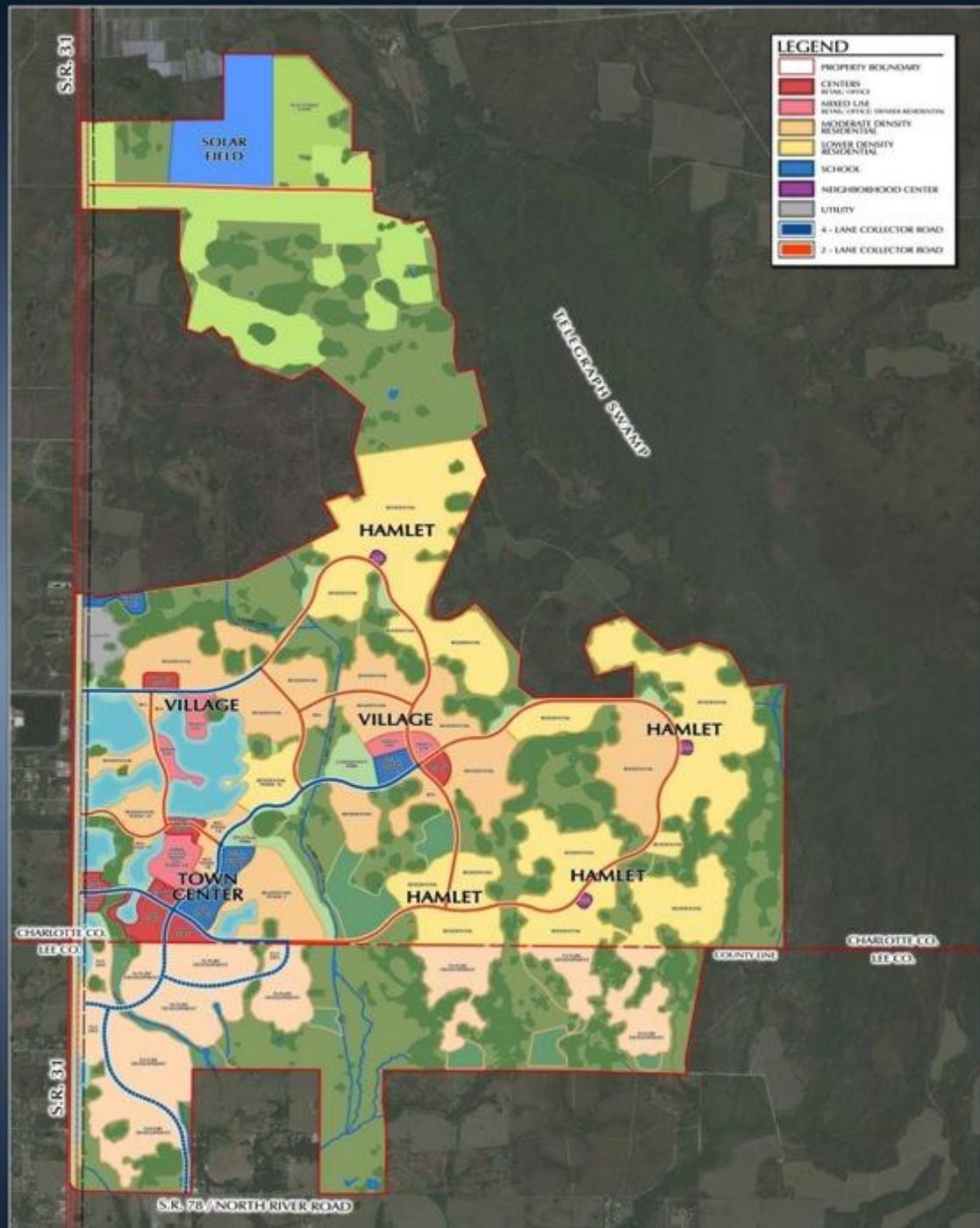
Core Initiative – Transportation

- Walkability
- Bikability
- Thoughtful Design of Trails, Walkways, Roadways and Parking
- Bike Sharing
- Car Sharing
- Connected Vehicles
- Autonomous Vehicles
- Mobility Services
- Goods Delivery

Babcock Ranch Master Plan

- 50,000 Residents
- 28 Sq. Mi.
- 1800 Residents/Sq. Mi.

*Ideal for
Driverless-
Shared
Vehicles!!*





In Closing...

- Transportation is ripe for transformation
- Florida is well-positioned to help lead this transformation
- Kitson & Partners is
 - Exploring driverless vehicle demonstration projects for Babcock Ranch
 - Seeking collaborators to develop and deploy a driverless-shared vehicle system at Babcock Ranch

Back-Ups

Manhattan Taxis



- 1.6 million people
- 23 square miles
- 410,000 taxi trips per day
 - 0.3 trips per adult
 - 88% internal to Manhattan
- Average Trip
 - 1.4 passengers
 - 5 minute wait time
 - 2 miles
 - 11 minute travel time
 - 11 mph
 - 0.6 empty mile per loaded mile
- Taxicab Fleet
 - 13,000+ vehicles

Manhattan Taxis Results

9,000 driverless-shared vehicles could

- Reduce cost per trip from \$7 to \$1
- Improve response time from 5 min to 1 min
- Reduce empty miles per loaded mile
from 0.60 to 0.05