The algorithms tested in the Madrid EBSF2 demo have been implemented in the driving assistance system Econbus
PT Specialized Eco-driving

- **Ecodriving Systems**
  - With Backoffice BI
  - Just Indications To driver

- **Buses**
  - Fixed Routes
  - Demand Periods
  - Frequent stops at known points
  - Many drivers per vehicle
  - Timetable to meet HVAC

- **Commercial vehicles**

- **Private Cars**
Rationale

- Training drivers in eco-driving can achieve reductions in fuel consumption ranging typically from 5 to 20% showing that there is room for optimization in almost any bus fleet.

- Efficient driving not only saves fuel; it also reduces maintenance costs, lowers accident rates and improves the traveler experience.

- In practice, the effectiveness of eco-driving courses decreases with time and drivers gradually go back to their usual way of driving.

- Frequent training of drivers is just too expensive; but even in that case, without an eco-driving system, there is no way to know which drivers and how much they comply with the eco-driving guidelines, and there is no way either to measure the results.

- Therefore Econbus has three main goals:
  - Maintain the eco-driving results over time
  - Measure the fuel savings achieved
  - Measure the driver’s conformance and allow a fair comparison among drivers
Fuel Consumption Factors

**DRIVER**
- Efficient Handling
- Drive at the right speed
- Use the correct gear
- Shut the engine down in standby

**DRIVE AT THE RIGHT SPEED**
- Gently braking and acceleration
- Anticipatory driving
- Uniform velocity
- Avoid accelerating downhill
- Avoid breaking uphill

**VARIABLE**
- Timetable delay/advance
- Demand period
- Day type
- Number of stopplings
- Passenger load
- Number of bus stops
- Type of route (urban/interurban)
- Type of engine, weight...
- Weather
- Type of fuel

**JOURNEY**
- Vary in speed
- At stops
- At traffic lights and others

**JOURNEY PATTERN**
- Slope
- Road layout (sharp bends)

**FIXED**
- Type of route (urban/interurban)
- Time in delay/advance
- Between stops
- At stops
- At intersections

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Comfort Factors

Driver
- Intensity, duration and frequency of braking
- Cornering speed
- Abruptness at stopping
- Rough ride on speed bumps

Variable
- Demand period
- Day type
- Number of stopplings
- Passenger load
- Number of bus stops
- Type of route (urban/interurban)
- Road layout (sharp bends)

Journey Pattern
- Type of route (urban/interurban)
- Road layout (sharp bends)

Fixed
- Air conditioning
- Bus suspension system
- On board information
- Cabin layout and space

Journey
- Travel time
- At stops
- At traffic lights and others

Varying in Speed
- Variations in speed

Comfort
Indications to drivers while driving

Warning indicators

Long term indicators

True Acceleration and braking
Driving operations

- Monitoring events in traffic
- Monitoring the departure operation
- Monitoring the approaching operation
- Monitoring idle time
Monitoring a departure from Stop
Measuring fuel savings

The Reference Fuel Consumption is the **fuel that would have been consumed during the calculation period if drivers had driven as in the reference period**.
Components of Econbus

- Driving processor
- Online Configuration
- Driver console

ECONBUS BI

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Thanks!