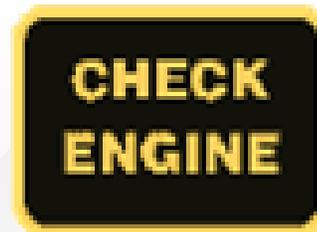


# Introduction To OBD II



**George E. Pataki**  
Governor

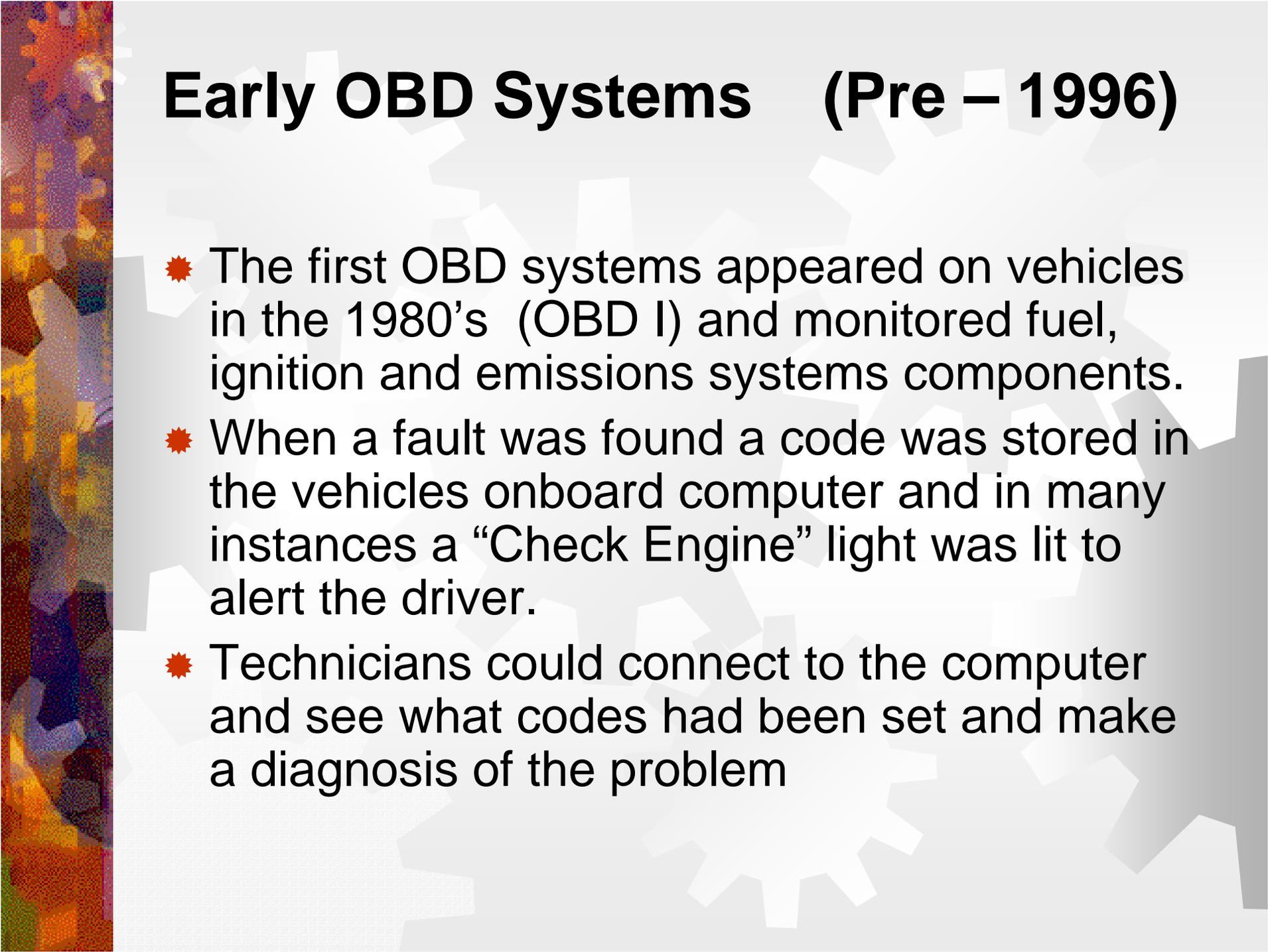
**Raymond P. Martinez**  
DMV Commissioner

**Erin M. Crotty**  
DEC Commissioner



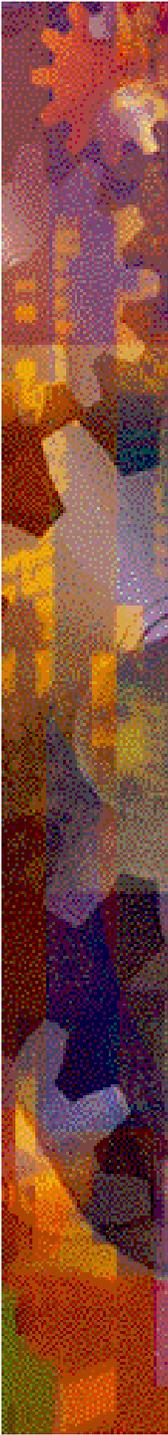
# Introduction

Onboard Diagnostics, **OBD**, technology benefits motorists, technicians and the environment by monitoring a vehicles performance every time it is driven, identifying performance and emissions problems immediately and providing technicians with information to help them quickly and accurately diagnose and repair malfunctions



## Early OBD Systems (Pre – 1996)

- ✿ The first OBD systems appeared on vehicles in the 1980's (OBD I) and monitored fuel, ignition and emissions systems components.
- ✿ When a fault was found a code was stored in the vehicles onboard computer and in many instances a “Check Engine” light was lit to alert the driver.
- ✿ Technicians could connect to the computer and see what codes had been set and make a diagnosis of the problem



# Early OBD Systems (Pre – 1996)

(Continued)

While the concept was a good one, several practical problems were found in actual use.....

- ✱ No Standardization of data link connectors – a different one needed for each manufacturers vehicles
- ✱ Trouble codes not consistent between manufacturers
- ✱ No standardization of emissions control device and system names between manufacturers
- ✱ Criteria to light check engine light not consistent between manufacturers
- ✱ Type of stored information in vehicles computer varied from manufacturer to manufacturer



# OBD II Systems

Noting that OBD systems were valuable technology in maintaining good performance and lower emissions in vehicles, the U.S. EPA developed regulations that required all vehicles meet specific and consistent standards for OBD systems, **OBD II**, by 1996

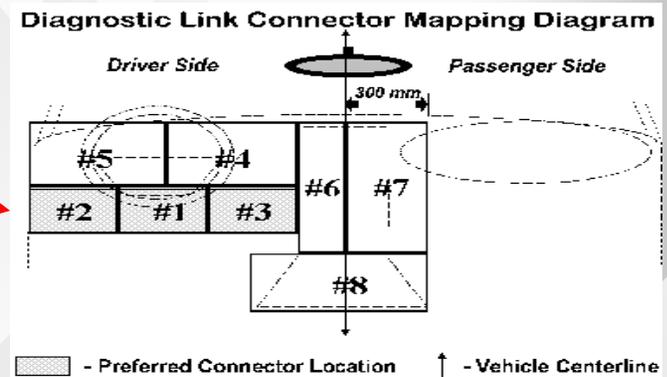
These regulations resulted in standardization of,

- ✿ Data Link Connector and location in vehicle
- ✿ Terminology for vehicle emissions control components
- ✿ Diagnostic trouble codes
- ✿ Freeze Frame – storage of engine conditions at time a DTC is set
- ✿ Requirements for lighting MIL (Check Engine Light)
- ✿ Determination and recording of readiness status of system monitors

# DLC

## Standardized Data Link Connector

- ★ Allows generic scan tool to be used on all OBD II equipped systems.
- ★ Contains 16 terminals – some OBD II dedicated and some manufacturer discretionary.
- ★ Location of DLC standardized.



# Standardized Terminology

- ✱ Different manufacturers used different names / acronyms for essentially the same components / systems.
- ✱ The Society of Automotive Engineers, S.A.E., developed standardized terminology for engine and emissions systems.
- ✱ See Glossary in Inspectors Reference Guide for examples.

**ECM**      **ECV**  
**EECP**      **ECA**      =      **PCM**



# OBD Failure Criteria

- ★ **Reasons for failing an OBD II inspection**
  - ★ **MIL does not light with key on – engine off (KOEO)**
  - ★ **MIL is lit with the key on - engine running (KOER)**
  - ★ **Scan tool indicates DTC's, and MIL is commanded on by the PCM, even if it is not lit**
  - ★ **More than the allowable number of monitors are found to be “not ready”**
  - ★ **DLC is missing or damaged – communications failure**

# MIL

## Malfunction Indicator Light

- ✱ The MIL is a light on the dashboard to alert the driver of an emissions related problem. The MIL will be lit if one of the following conditions is present,
  - ✱ Severe misfire which could cause catalytic converter damage will cause it to flash on and off.
  - ✱ A steadily lit MIL indicates a DTC has been set.
- ✱ The OBD II system can turn the MIL off on it's own if it detects that the cause of the MIL being lit has been corrected.

SERVICE  
ENGINE  
SOON!



CHECK  
ENGINE

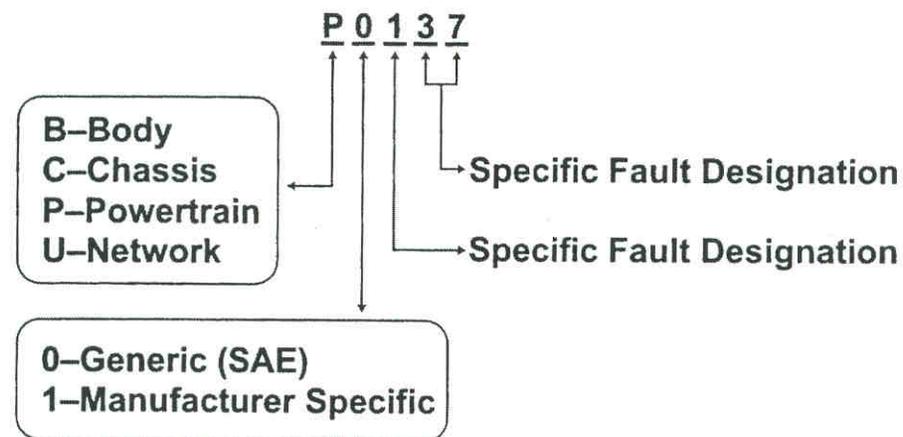
# DTCs

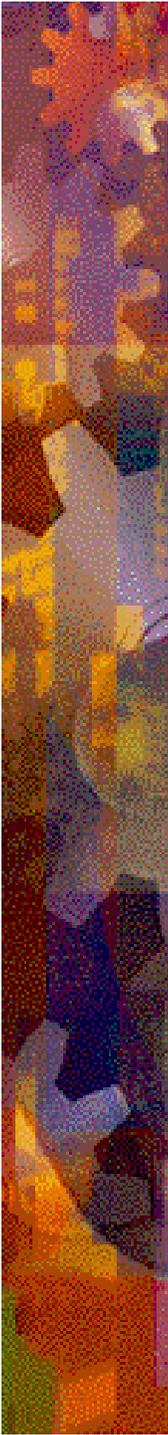
## Diagnostic Trouble Codes

- ✱ Prior to OBD II each manufacturer had it's own list of trouble codes.
- ✱ Under OBD II all manufacturers must use a universal 5 digit code system.

### DTC Structure

Example: P0137 Low Voltage Bank 1 Sensor 2





# DTC's

## Diagnostic Trouble Codes (Continued)

- ✱ There are two types of DTC's, 1 trip DTC's and 2 trip DTC's
- ✱ A 1 trip DTC is for a condition that requires immediate attention such as a catalyst damaging misfire.
- ✱ A 2 Trip DTC is one that a condition must be found during 2 consecutive trips such as an EGR fault.
- ✱ Most Monitors do not set a DTC and light the MIL when a vehicle fails a test for the first time during a DRIVE CYCLE. If a test is failed on a second consecutive DRIVE CYCLE the MIL will light and a DTC is stored in the vehicles powertrain control module (PCM).



# System Monitors & Readiness Status

- ★ One of the features of OBD II testing is that the vehicle need not be warmed up or pre-conditioned before doing the test.
- ★ The OBD system periodically runs what are called **MONITORS** to determine if the various emissions control devices and systems are **READY** and able to operate as they were designed.
- ★ Some Monitors are CONTINUOUS monitors and some are NON-CONTINUOUS monitors.
- ★ Monitors are run during what are called DRIVE CYCLES



# Continuous & Non-Continuous Monitors

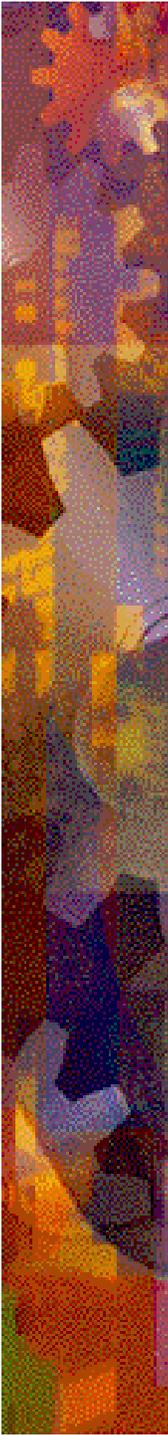
- ★ **Some vehicle components are continuously tested by OBD II while others are only tested under certain operating conditions.**

## Continuous Monitors

- Misfire
- Fuel System
- Comprehensive Components

## Non-Continuous Monitors

- EGR System
- O2 Sensors
- Catalyst
- Evaporative System
- Others (if vehicle equipped) –  
Secondary Air, Heated Catalyst,  
A/C System



# System Monitors & Readiness Status

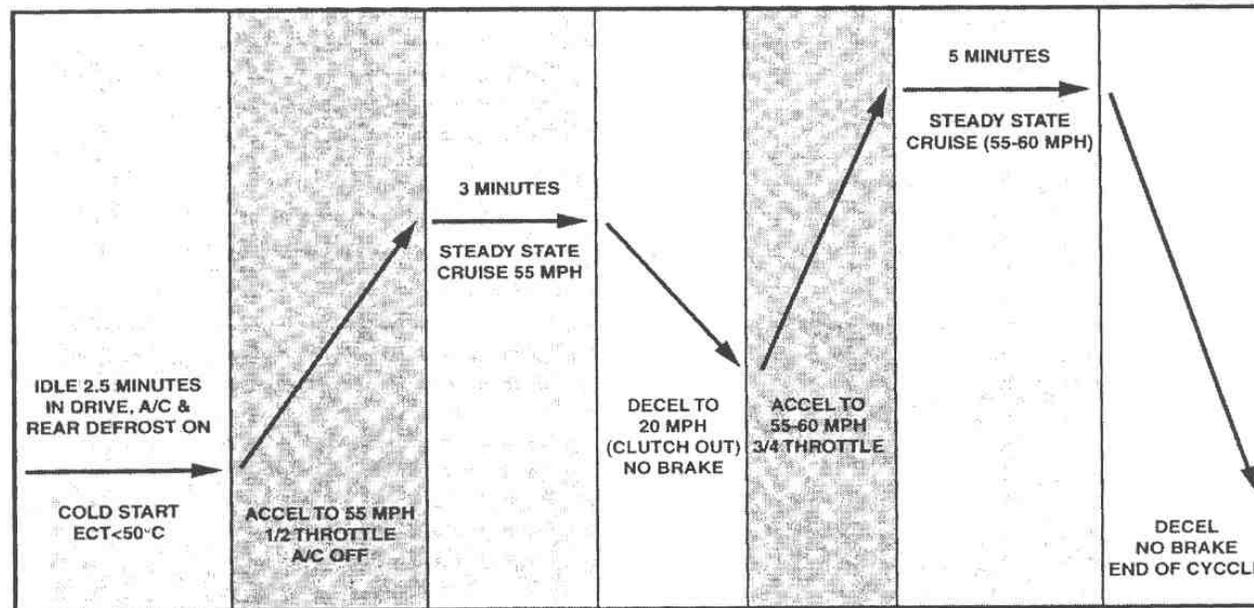
(Continued)

- ✱ If a Monitor is run completely and the system / component being tested operates properly, the monitor is recorded in the powertrain control module (PCM) as ready, complete or done.
- ✱ Disconnecting the vehicles battery or clearing stored DTCs from the PCM will usually reset the monitor readiness status to NOT READY
- ✱ 1996 – 2000 model year vehicles FAIL if more than 2 monitors are “Not Ready”.
- ✱ 2001 and Newer model year vehicles FAIL if more than 1 monitor is “Not Ready”.

# Drive Cycles

- ★ What constitutes a DRIVE CYCLE can vary from monitor to monitor and across all makes and models.

Typical Drive Cycle Routine



# Freeze Frame

- Whenever an emissions related malfunction occurs, OBD II stores the operating parameters (conditions) present at the time the malfunction occurs.
- Parameters recorded are, but are not limited to:
  - DTC Description
  - Engine Speed
  - Vehicle Speed
  - Air Flow
  - Engine Load
  - Fuel Pressure
  - Fuel Trim Value ( Rich or Lean )
  - Engine Coolant Temperature
  - Intake Manifold Pressure
  - Open or Closed Loop Status
- This data is valuable to assist technicians in diagnosing the cause of the malfunction.



# System Reports

The TLC equipment will continue to produce reports as in the past.

Rejection Notices for vehicles failing an OBD II inspection will contain the following added information,

- ✿ Status of communication with PCM
- ✿ Listing of DTC's found stored
- ✿ Number of monitors found "Not Ready"
- ✿ MIL status check