

# Developing Integrated Emission Strategies for Existing Land Transport (DIESEL)



## Analysis and/or Testing of Polices and Technologies: General Guidelines

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# General Guidelines for the DIESEL Pilot

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- Urban transport policy not driven primarily by air quality considerations
- Focus on in-use vehicles and gross-polluters
- Select measures that reduce local air pollution & improve efficiency of the system
- Select ‘proven’ technologies considering the economic, institutional and policy framework
- Select measures that go along economic incentives for sector, especially operators and individual users



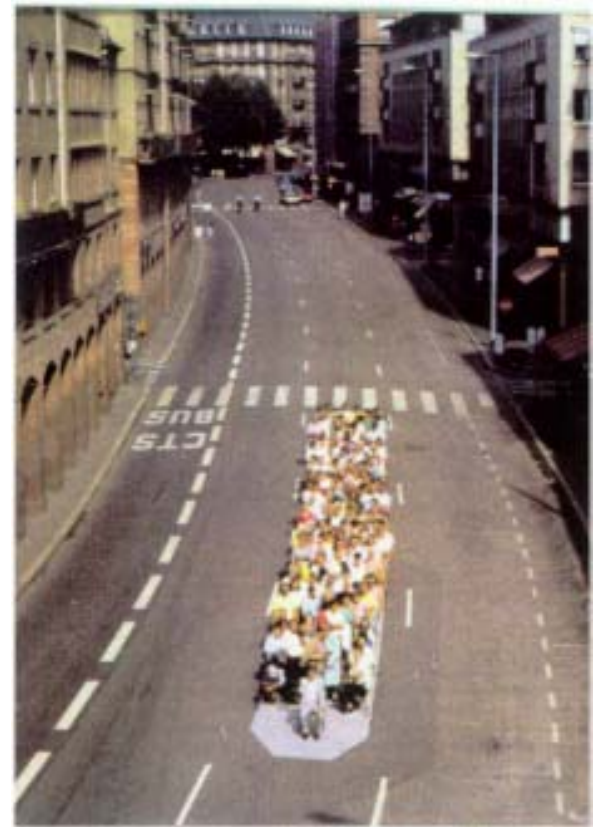
# Common Challenges in Transport Sector

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- Lack of preventive maintenance
- Widespread use of cheaper inferior-quality counterfeit spare parts
- Fuel adulteration
- Insufficient commercial incentives for proper vehicle maintenance and operation
- High capital and maintenance cost of new vehicle and fuel technology
- High technical skills needed to operate and maintain
- Inadequate enforcement of existing standards and regulations

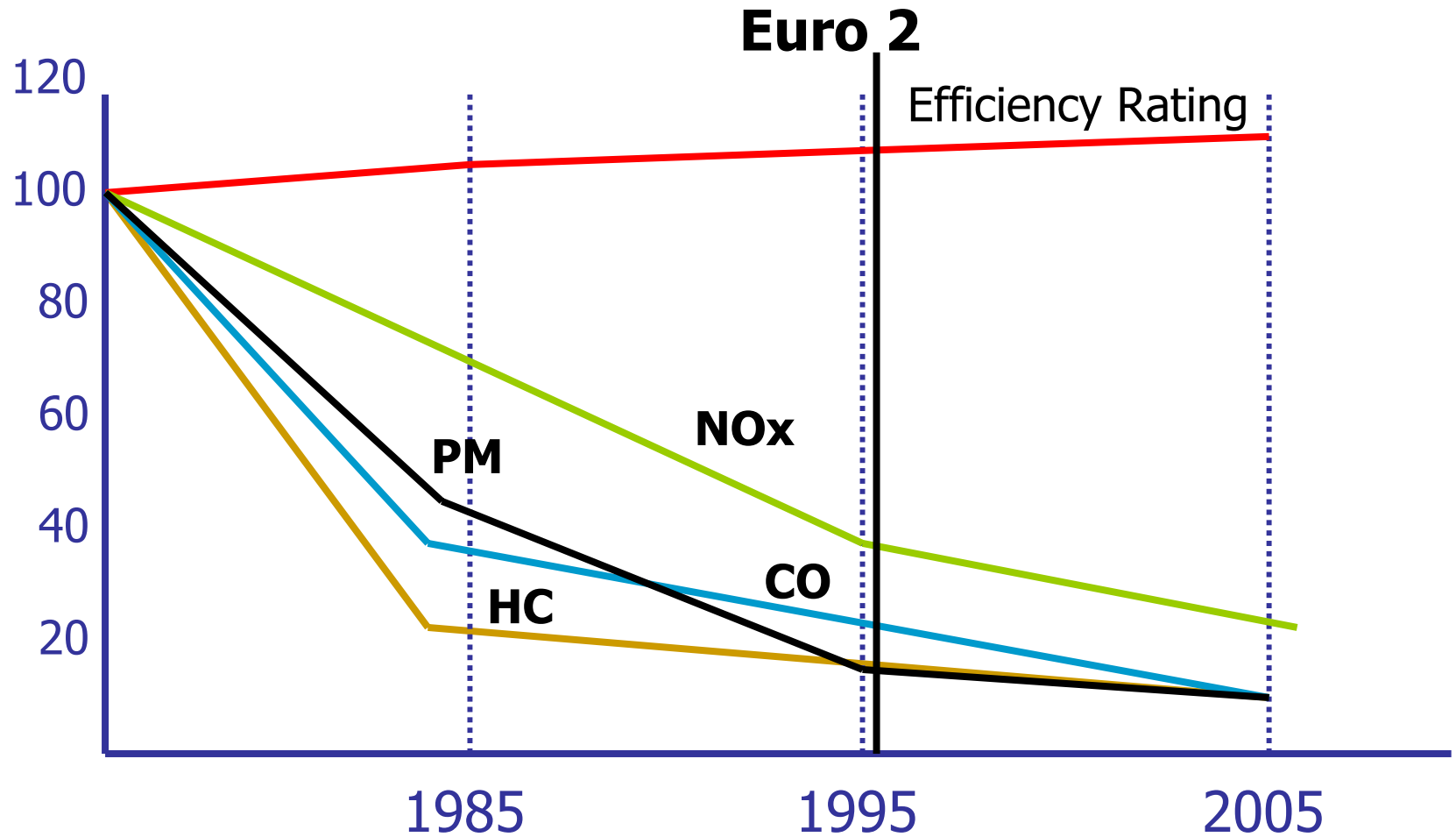
# Mass Transit Options?

Transport Capacity of 180 passengers



# Emissions, Diesel Engines

Index 100 = 1975



Source: Volvo Bus Corporation



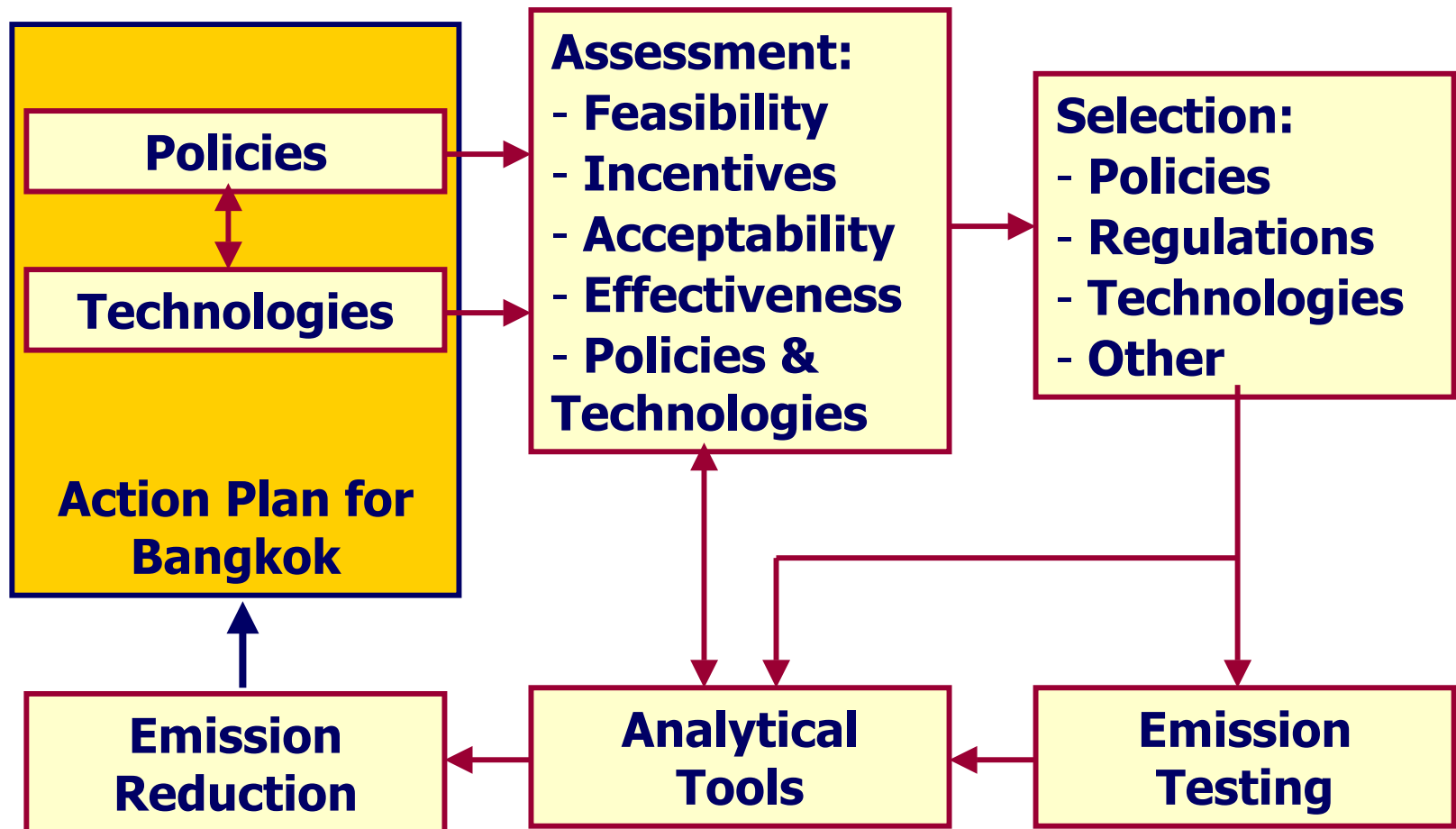
# How appropriate measures will be selected?

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- Cost and benefits
  - **Which measures are (likely) the most cost-effective (Bath/population exposure reduced)?**
- Compatibility with other sector objectives
  - **Do the measures reinforce existing sector objectives and economic incentives?**
- Political feasibility
  - **Is there broad support from public and stakeholders for the measure?**
- Ease of enforcement
  - **How difficult is the implementation and enforcement of the measure?**

Goals	Outcome	Activities	Pilots/ Demonstrations
<p><b>Improved Efficiency of the Transport System</b></p>	<p>Enhance Public Transport Encourage Walking/Biking Improve Traffic Flow Improve Driving Behavior</p>	<ul style="list-style-type: none"> <li>■ Improve Capacity for Transport System Planning &amp; Management</li> <li>■ Segregated Bus/Bike/Car-Pool Lane Networks</li> <li>■ Strengthening Area Traffic Control</li> <li>■ Traffic &amp; Parking Regulation</li> <li>■ Design Codes &amp; Guidelines</li> <li>■ Training/ Awareness-building</li> </ul>	<ul style="list-style-type: none"> <li>■ Lab: Testing smoother driving cycles (reflecting driver behaviour, segregated lanes, coordinated signals)</li> <li>■ In-Situ: Observational survey for traffic options analysis</li> <li>■ Analytical: Model transport systems options</li> </ul>
<p><b>Reduce Emissions from In-use Vehicles</b></p>	<p>Enhance Inspection Programs     Bus fleets     Other vehicles Improve Maintenance Culture and Capacity</p>	<ul style="list-style-type: none"> <li>■ Vehicle Maintenance     Routine tune-ups (e.g. injector cleaning, air filter, fuel filter and oil filter cleaning / replacement)     Adjusting Air-Fuel Ratio     Using certified spare parts</li> <li>■ Training/ Awareness-building</li> </ul>	<ul style="list-style-type: none"> <li>■ Lab: Testing of effectiveness of different types of tune-ups</li> <li>■ In-Situ: Test opacity, rapid loaded test for emissions, fuel efficiency survey</li> <li>■ Analytical: Model performance improvements of in-use vehicles</li> </ul>
	<p>Improve Technologies for Vehicles &amp; Fuels</p> <ul style="list-style-type: none"> <li>■ Use Cleaner technology for in-use Vehicles</li> <li>■ Use Cleaner fuels</li> </ul>	<ul style="list-style-type: none"> <li>■ Retrofit in-use Vehicles     Oxidation Catalysts, Particulate Traps, Alternative Fuel Kits</li> <li>■ Move to Cleaner Fuels/Lube     Inspections/ Reporting to Reduce Adulteration, Low S Diesel, Alternative fuels (incl. CNG/LPG), Lube substitution, Fuel additives</li> <li>■ Adjust Registration Cost</li> <li>■ Improve In-use Vehicle Emission Standards</li> </ul>	<ul style="list-style-type: none"> <li>■ Lab: Testing of effectiveness of selected retrofit and cleaner fuel options</li> <li>■ In-Situ: Test in-situ performance of selected retrofit/ cleaner fuel option (e.g. through driver survey, periodic tests)</li> <li>■ Analytical: Model retrofit/ cleaner fuel options</li> </ul>
<p><b>Improve Technology of New Vehicles</b></p>	<ul style="list-style-type: none"> <li>■ Establish Adequate New Vehicle Emission Standards</li> <li>■ Adjust Import Tariffs</li> <li>■ Establish Price/Tax incentives/ disincentives     Diesel &amp; Cleaner Vehicles</li> </ul>	<ul style="list-style-type: none"> <li>■ Improve new vehicle emission standards</li> <li>■ Encourage use of improved fuels</li> <li>■ Upgrade emission control technology</li> </ul>	<ul style="list-style-type: none"> <li>■ Lab: Tested by manufacturer</li> <li>■ In-Situ: Driver survey for new technology vehicles</li> <li>■ Analytical: Obtain performance information from manufacturers; Model new vehicle technology options</li> </ul>

# DIESEL Pilot: Process







# Analysis of Transport Policy Options

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- Public transport sector reform
  - Alternative licensing schemes
  - Bus fare policy
  - Mass transit policy
- Traffic management
- Strengthening of enforcement
- Clean fuel and vehicle technology
- Driver training and public education
- Review of and coordination with other on-going studies



# Analysis of Vehicles Technology Options

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- In-use vehicles
  - Emission standards
  - (Targeted) enhanced inspection system
  - Vehicle upgrade and scrappage
  - Retrofit programs
  - Operational misuse (over-loading, over-fueling)
  - Pilot testing corrective measures
- New vehicles
  - Emission standards



# Emission factor development for diesels

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- Study design
  - Methodology
  - Possible parameters to be tested: age, technology employed, clocked km, state of repair, lubricant quality, fuel formulation, vehicle size, drive cycle
  - Use of factorial design to determine test matrix
  - Logistics for vehicle procurement
- Data generation
- Possible development of improved test protocol for use in inspection program
  - Alternative to snap acceleration smoke

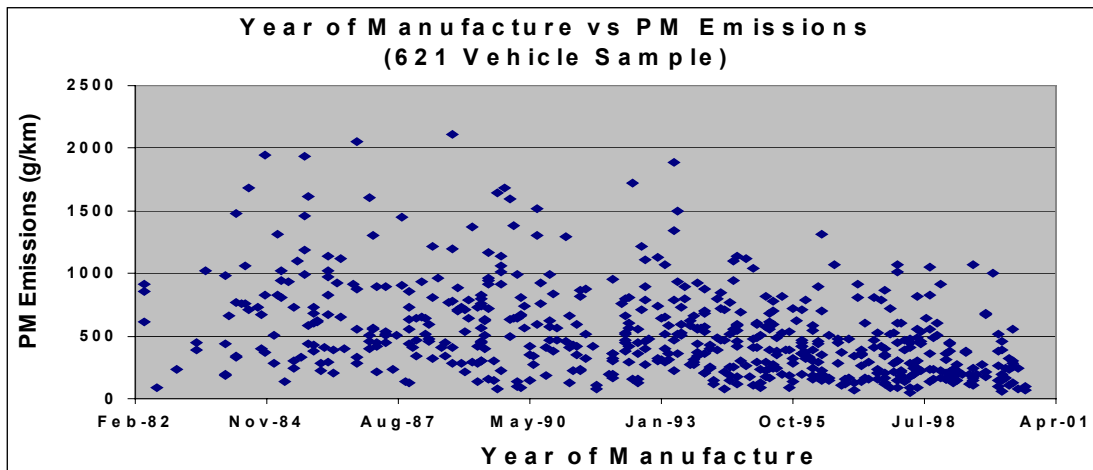
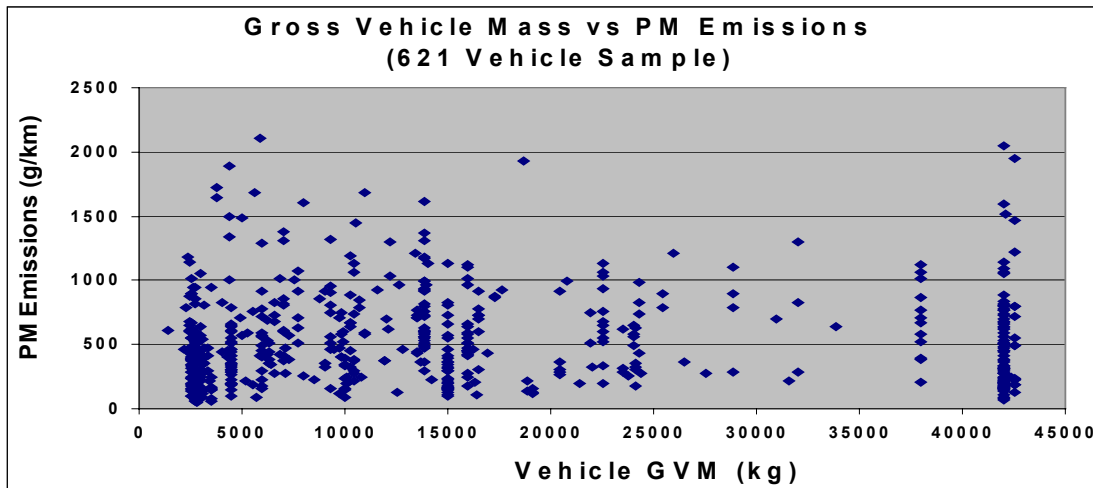


## Main Activities of the DIESEL Pilot

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- Gathering of existing data – mostly done, although some gaps remain
- Design of test protocol – draft ready, learn from POINT experience
- Select options – main task, will depend on resources
- Emission testing – select measures to be tested, depend on resources
- Analysis of policies

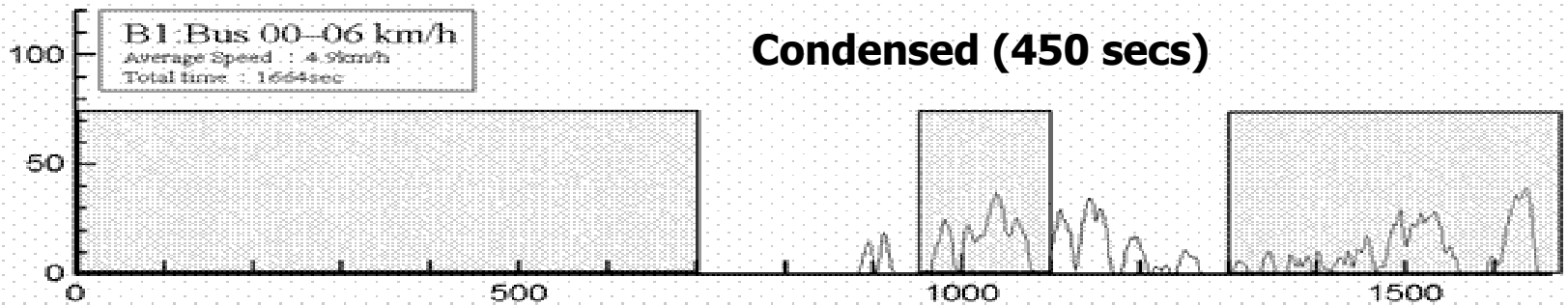
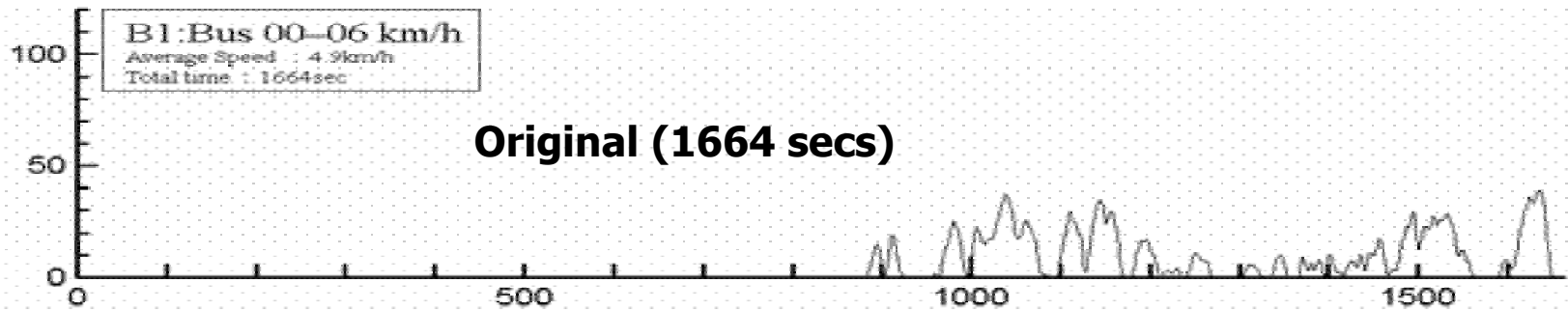
# PM Emissions Variability



PM can vary by more than an order of magnitude in any age/ type category – need a lot of data points to effectively cope with scatter.

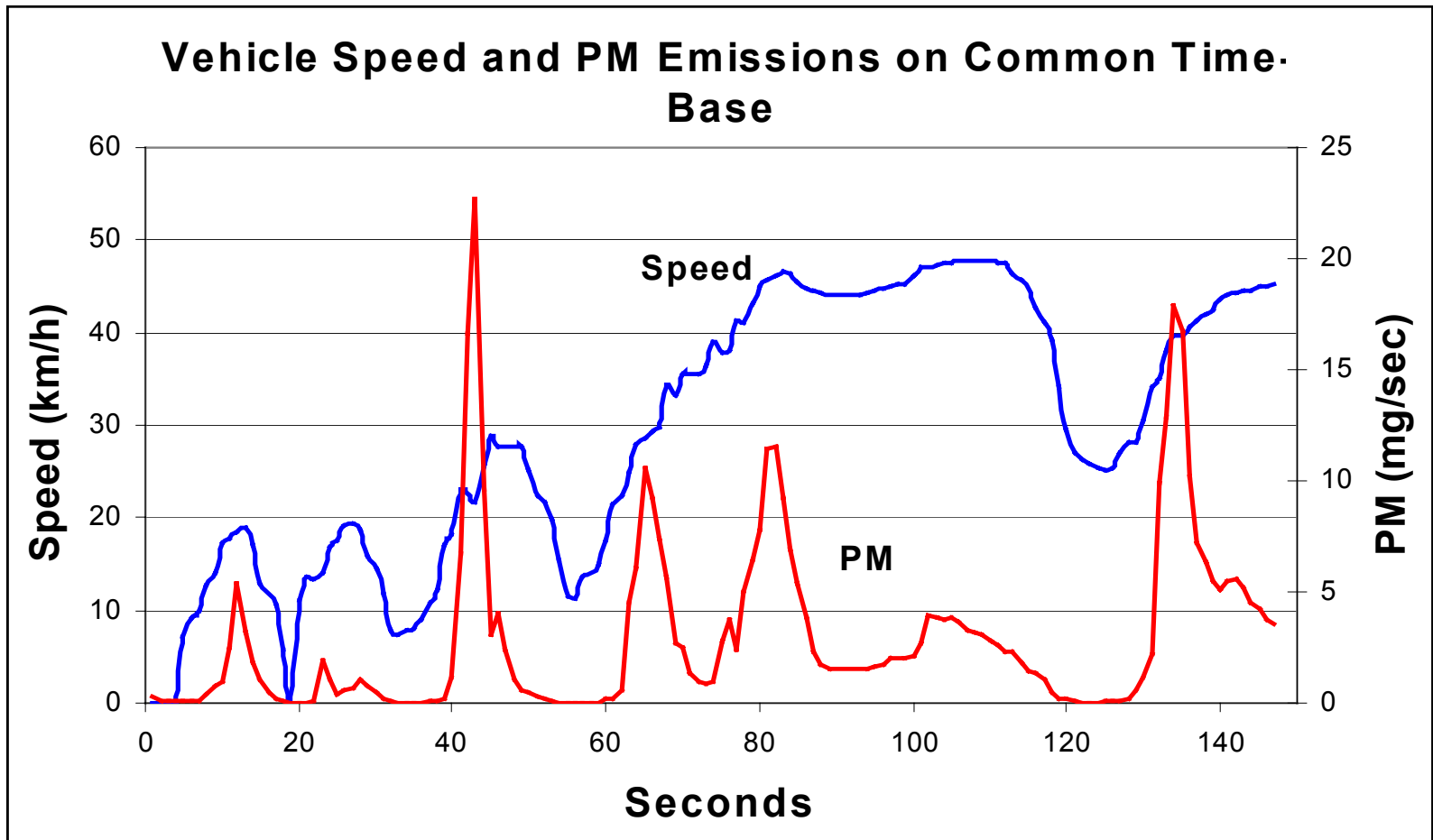
# Condensing a Drive Cycle

## Example of Condensed Drive Cycle



**Delete “greyed” sections**

# Real-Time Emission Data





## Diesel Pilot: Emission Testing

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- More resources needed: private sector, donors, etc
- POINT Project already testing 75 diesel veh.
- Between PCD & World Bank:
  - Develop test protocol
  - Pre-select sample
  - Conduct 150 tests
- Options to be tested
  - Baseline (yes!) – at least 50 tests!
  - Maintenance options?
  - Retrofit options?
  - New technologies/fuels?





# Summary

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- Keynotes are:
  - Pragmatic approach to testing methods
  - Maximising the value of test data
  - Efficient vehicle logistics management
- Related Documents:
  - “Bangkok Diesel Emissions Reduction Project: Project Plan (Vehicle Testing)”
  - “Options for Diesel Emission Factor Testing in Asian Cities”