

GRRF TPMS Task Force Conclusions

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BACKGROUND

Task Force Members

Contracting Parties

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- Johannes J. Baumhöfer (Continental)

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- Frederic Arbousse-Bastide (Schrader)
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- Bernard Jacquin (Conti VDO)
- Paul Jennison (Knorr Bremse)
- Wim Verhoeve (CLEPA) - Chair

Objective of the Task Force

The Force Group (TFG) agrees on the following objective of the TF:

- Collect figures and data about the number of vehicles which are driven with under-inflated tyres, the number of under-inflated tyres on each vehicle and the degree of under-inflation and the effect of this on the fuel consumption, tyre wear, CO2 emission, safety etc.
- Measure the effect of TPMS and other solutions
- Review & validate available data.
- Define 'under-inflation' and how to measure it.
- Agree on the values to be used for the GRRF TPMS Informal WG meeting.

Task Force meetings

The Force Group (TFG) held 2 meetings:

1. 12 February 2008, Brussels (CLEPA Offices)
2. 11 March 2008, Brussels (CLEPA Offices)

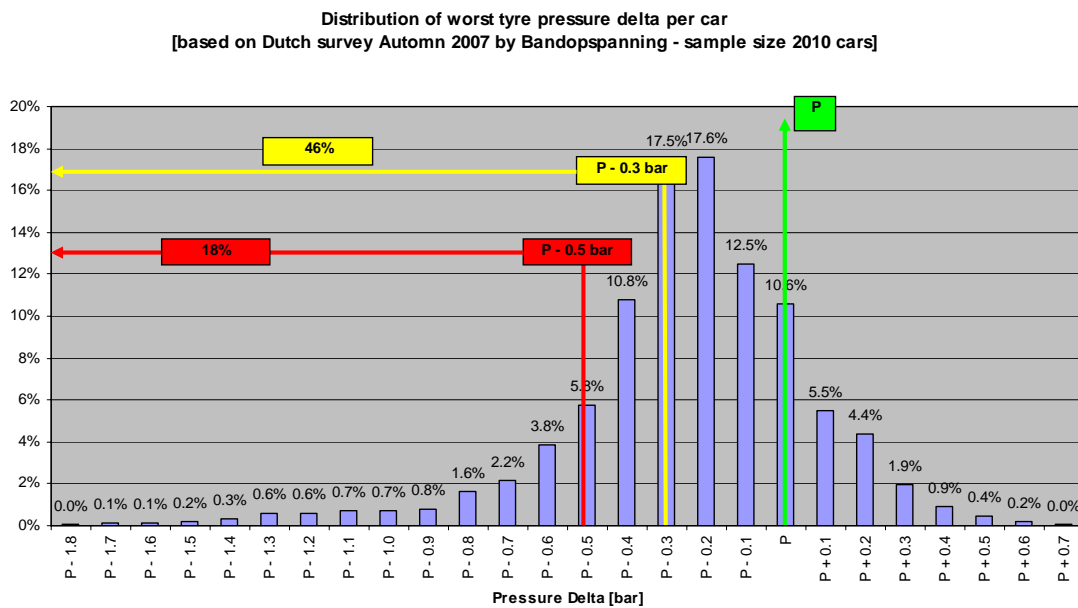
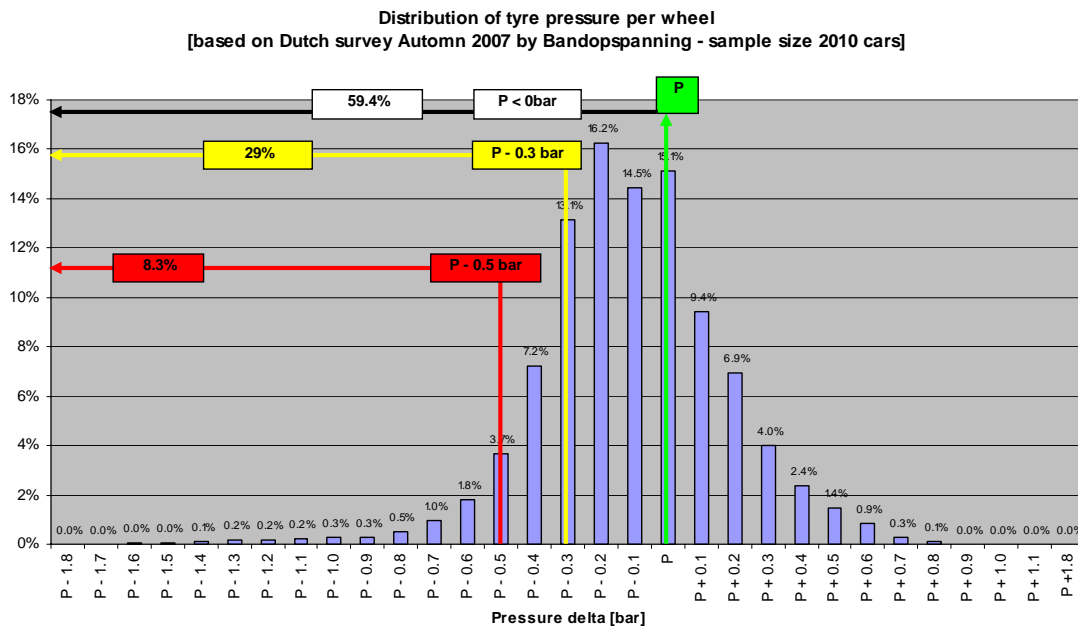
SECIION A: Passenger Cars (PC)

1. Distribution of actual tyre pressure on the road

The Task Force Group (TFG) agrees that the following data coming from the Netherlands (NL), Michelin (UK & F) and JASIC (JP) is representative for the real tyre pressure distribution on the road and can be used for the cost/benefit calculations.

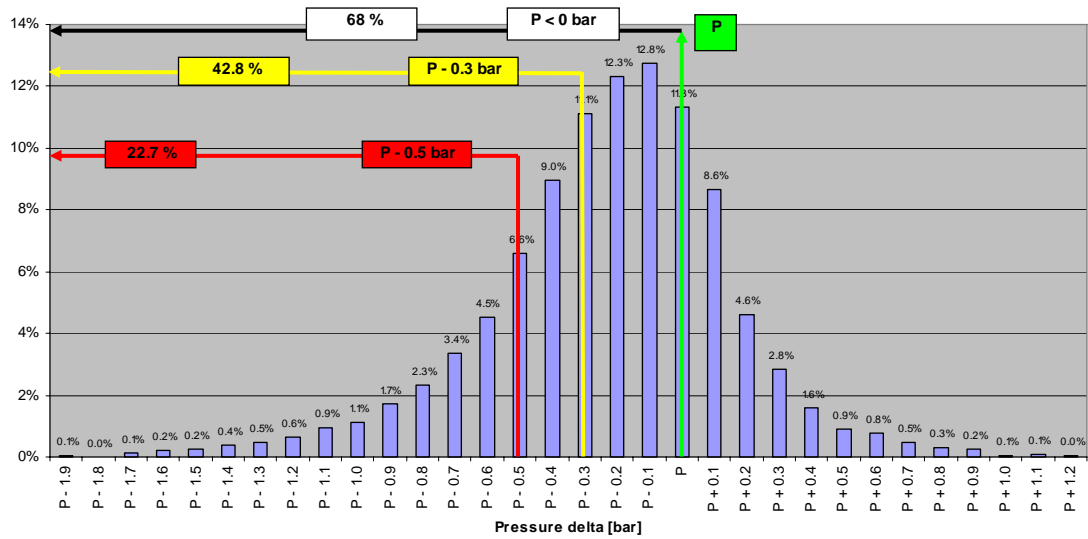
The histograms below give a summary of the tyre pressure distribution for each of the data sets:

1.1. The Netherlands data (NL)

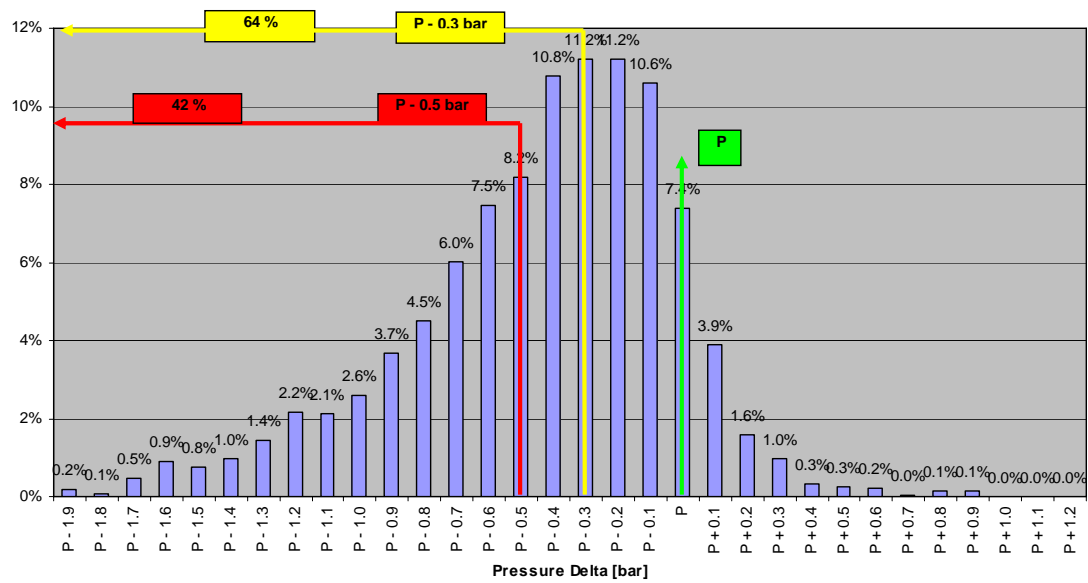


1.2. The Michelin data (UK)

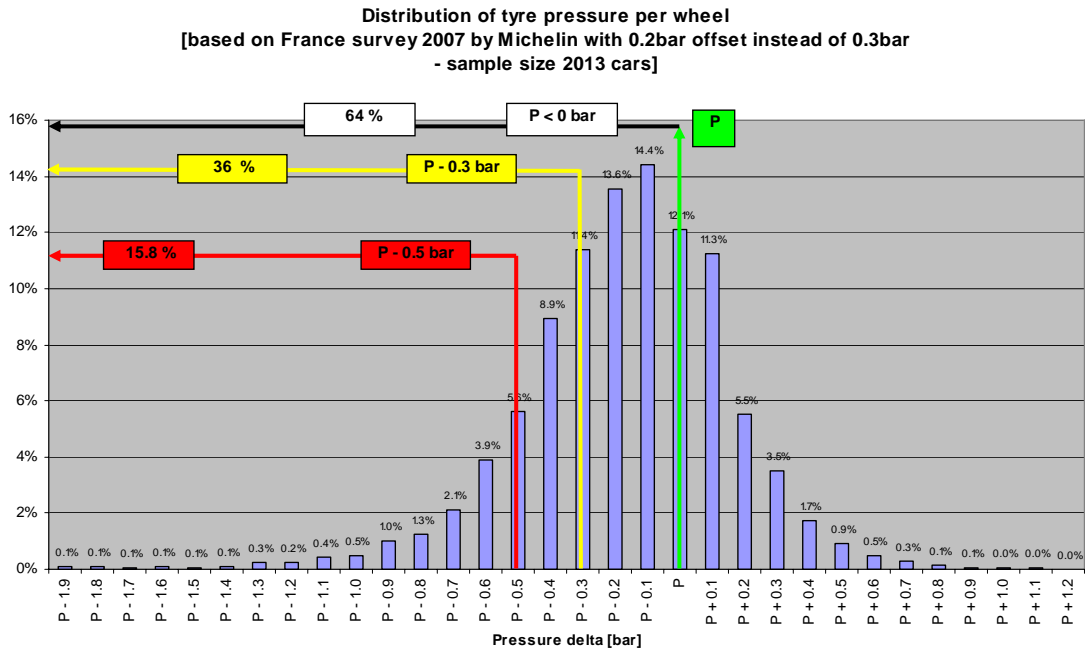
Distribution of tyre pressure per wheel
 [based on UK survey 2007 by Michelin with 0.2bar offset instead of 0.3bar - sample size 2373 cars]



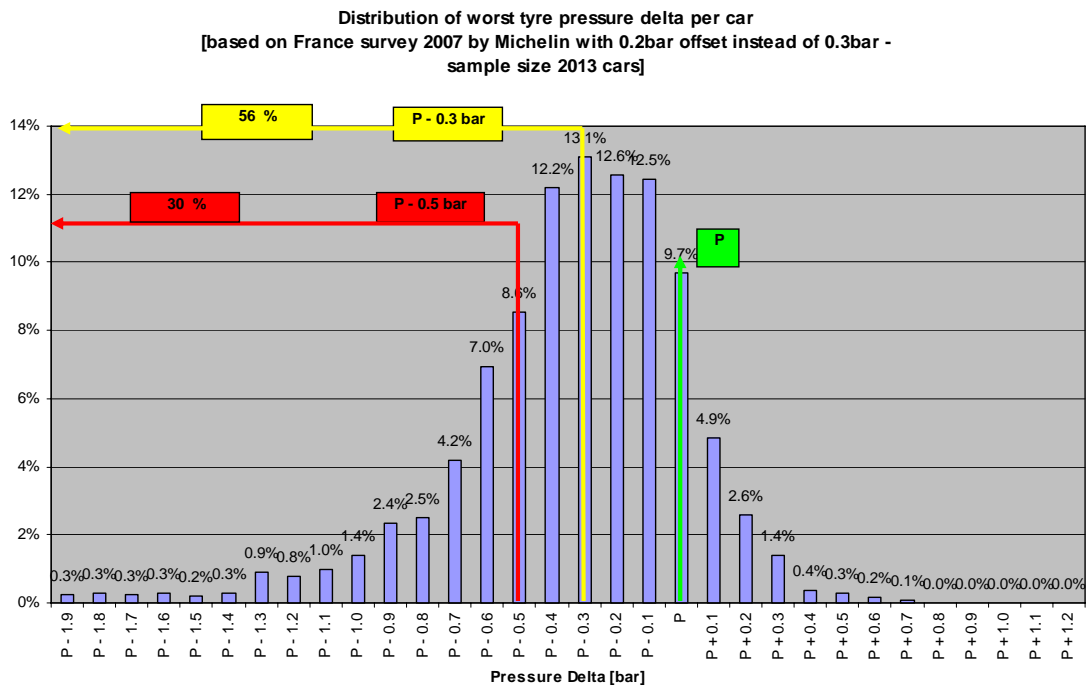
Distribution of worst tyre pressure delta per car
 [based on UK survey 2007 by Michelin with 0.2bar offset instead of 0.3bar - sample size 2373 cars]



1.3. The Michelin data (F)

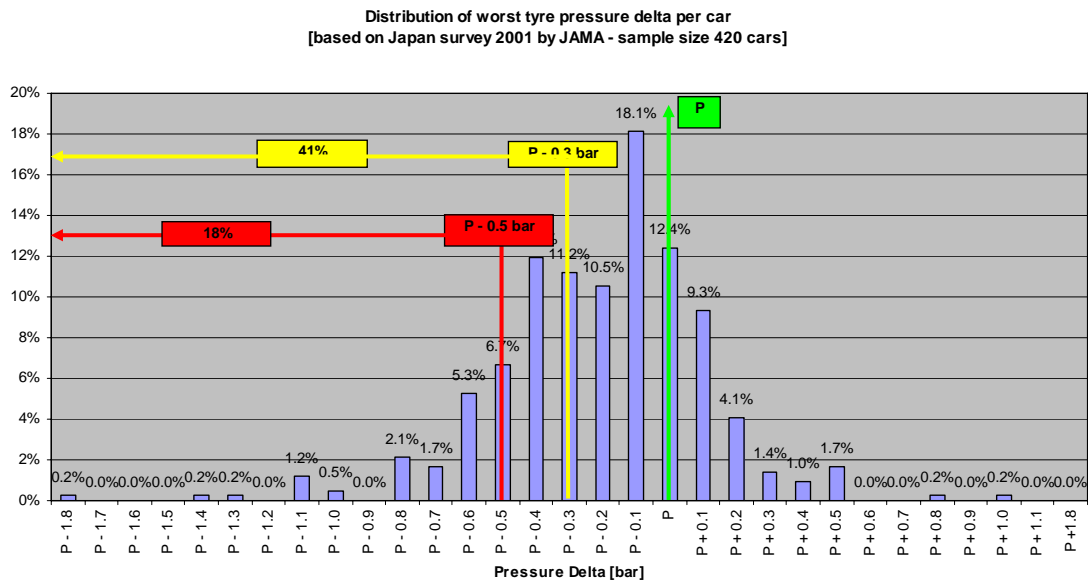
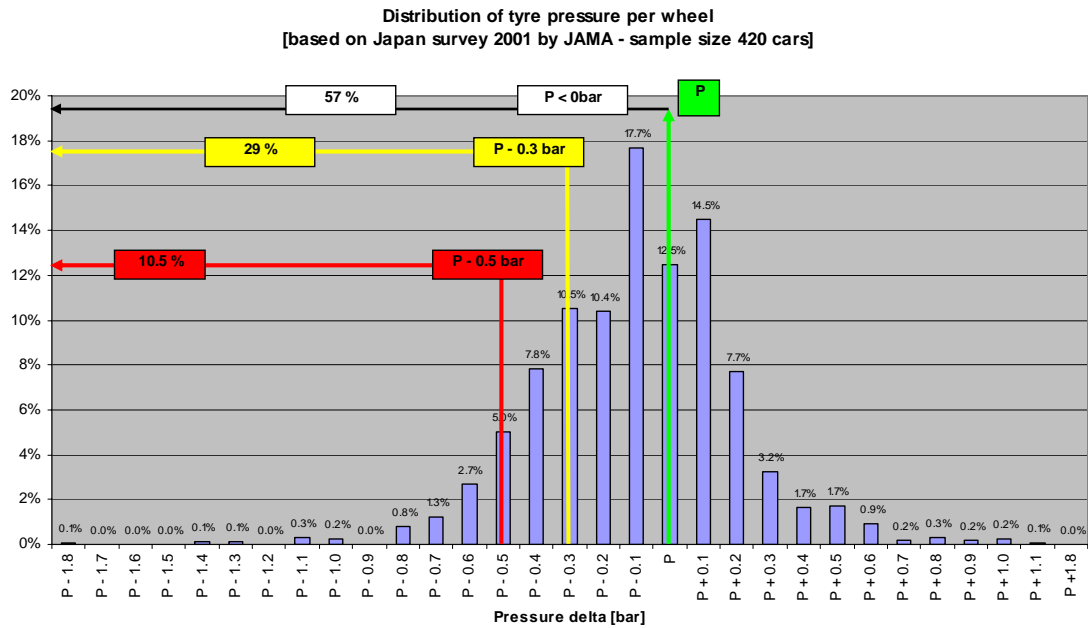


Note: updated graph above (compared to version 02 of the document).



Note: updated graph above (compared to version 02 of the document).

1.3. The JASIC data (JP)



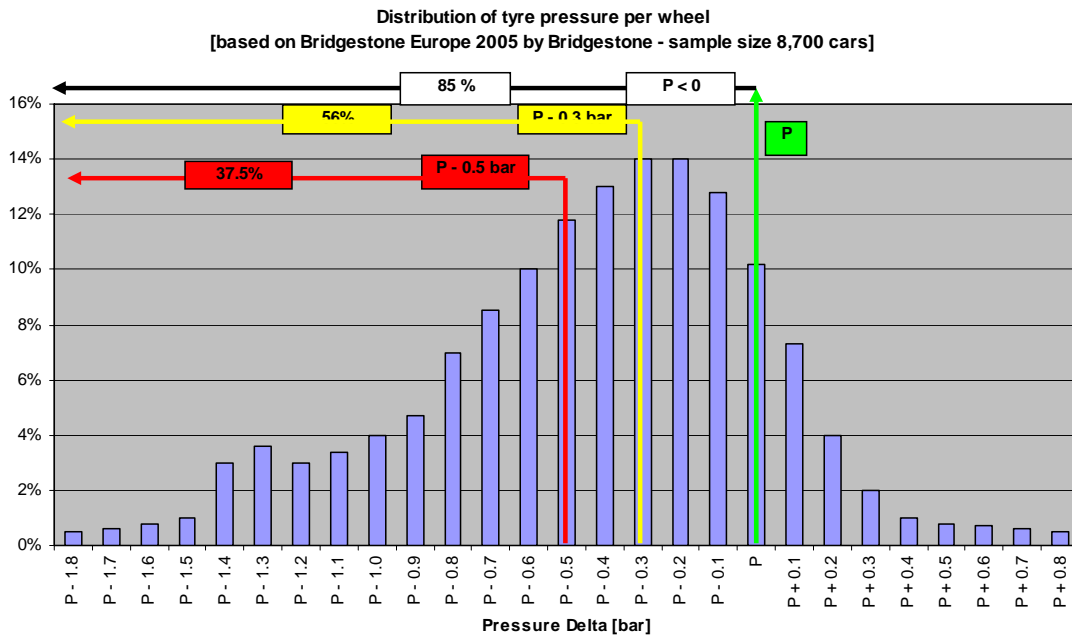
This data can be divided in 3 groups with a total of 228 million vehicles in Europe:

1. JP & NL 45% of all vehicles
2. F 30% of all vehicles
3. UK 25% of all vehicles

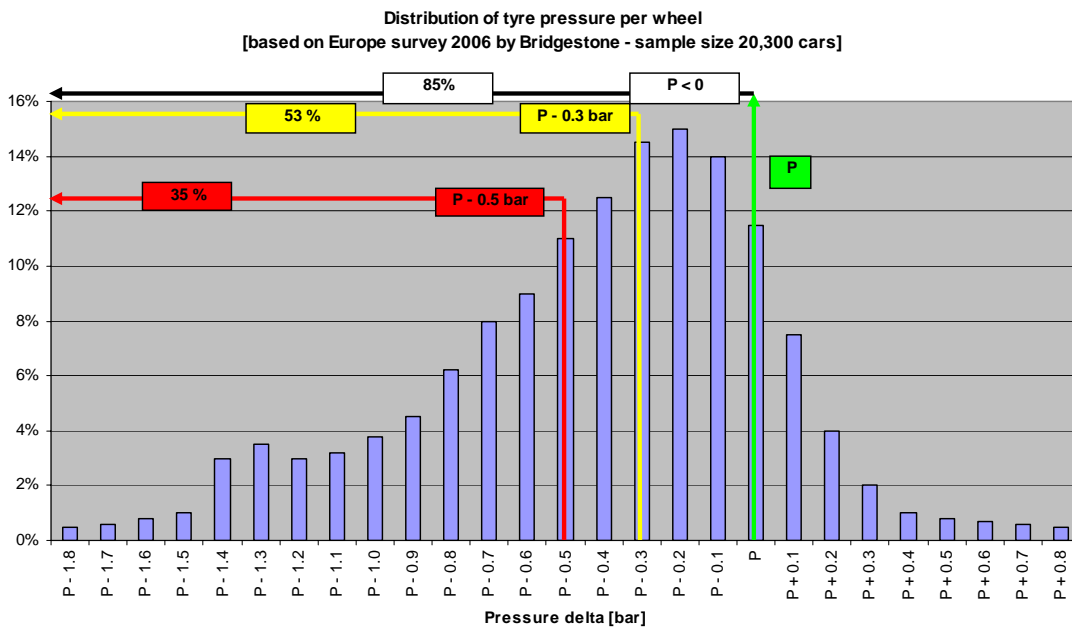
The Task Force Group (TFG) could not reach an agreement to use the Bridgestone data for the calculations (present below) because the raw data is not made publicly available to the group.

1.4. The Bridgestone data (EU – 19 countries)

Note: raw data not publicly available



Note: updated graph above (compared to version 02 of the document).



Note: updated graph above (compared to version 02 of the document).

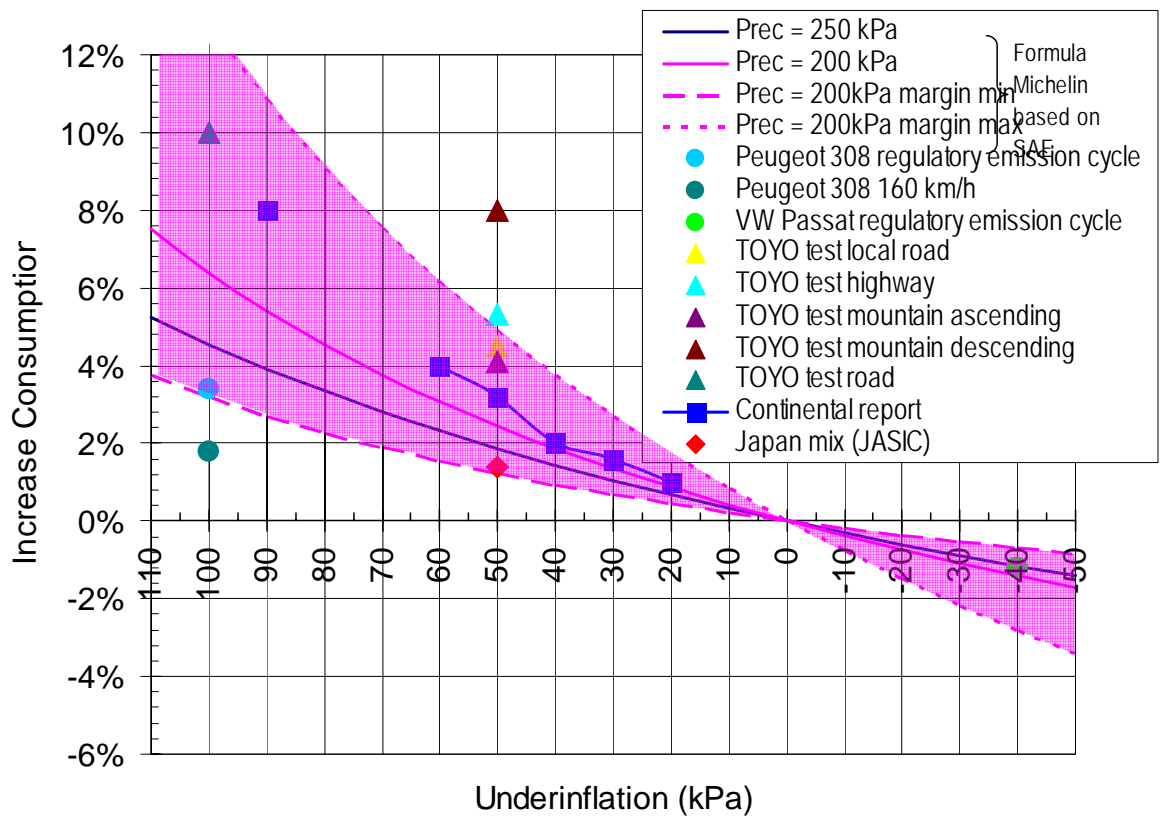
2. Effect of under-inflation

2.1. Fuel consumption

There is data available obtained by basically different 2 test methods:

| Method | Drawback |
|---|---|
| Measuring fuel consumption while driving on a road. | Speed profile not exactly repeatable. |
| Measuring fuel consumption by using the standard homologation test cycle on a test bench. | Test does not take into account all road conditions (e.g. tyre behavior in curves). |

The TFG agrees to use a formula based on the test results obtained with the standard homologation test cycle and add a margin to the obtain a curve to compensate for the real life conditions based on the tests performed on the road.



Note: updated graph above (compared to version 02 of the document).

For applying the above formula on the selected data sets of paragraph 1, there are again two different calculation methods. The TFG could not conclude on which method to use, hence the results of both methods are shown below. The TFG will continue to investigate the differences and try reach an agreement.

Calculation Method 1

| Fuel consumption increase summary | Total max | Total min |
|---|-----------|-----------|
| Dutch survey (%) - 4 wheels | 1.61% | 0.40% |
| Japan survey (%) - 4 wheels | 1.53% | 0.38% |
| UK survey - 0.2bar offset (%) 4 wheels | 2.79% | 0.69% |
| France survey (%) 4 wheels | 2.14% | 0.53% |
| | | |
| <i>Average</i> | 2.02% | 0.50% |

Note: updated table above (compared to version 02 of the document).

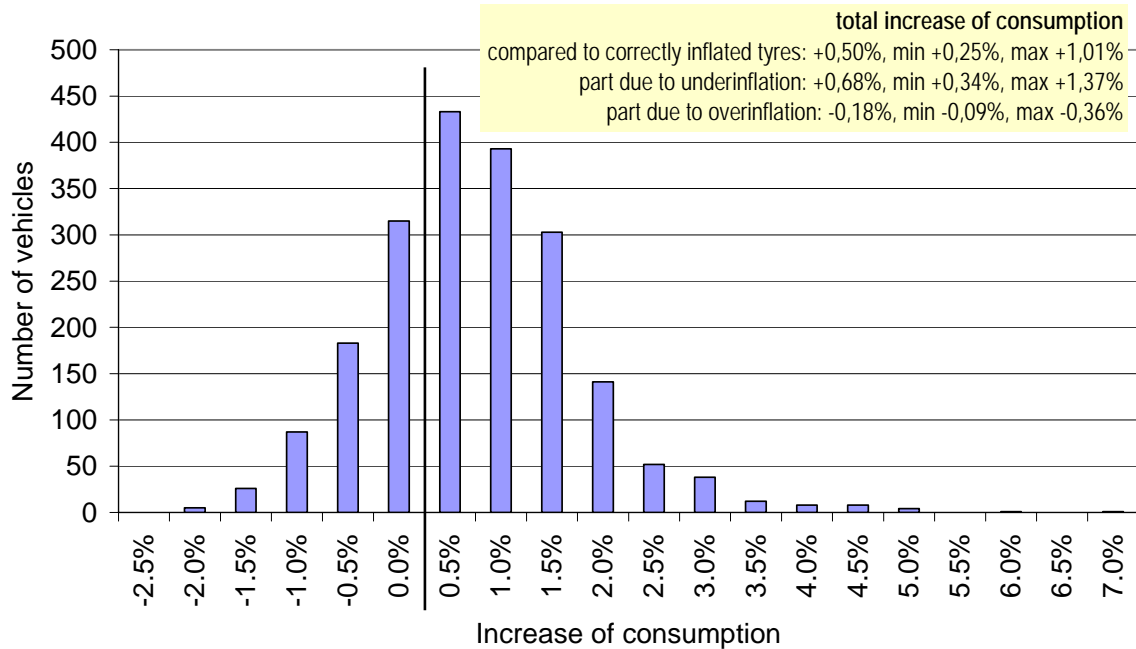
Calculation Method 2

| | Formula Michelin based on SAE | margin min | margin max |
|-----------------------|-------------------------------|------------|------------|
| NL survey | | | |
| Total increase | 0.50% | 0.25% | 1.01% |
| due to underinflation | 0.68% | 0.34% | 1.37% |
| due to overinflation | -0.18% | -0.09% | -0.36% |
| Japan survey | | | |
| Total increase | 0.50% | 0.25% | 1.00% |
| due to underinflation | 0.72% | 0.36% | 1.45% |
| due to overinflation | -0.22% | -0.11% | -0.45% |
| France survey | | | |
| Total increase | 0.68% | 0.34% | 1.37% |
| due to underinflation | 0.85% | 0.42% | 1.70% |
| due to overinflation | -0.16% | -0.08% | -0.33% |
| UK survey | | | |
| Total increase | 1.03% | 0.51% | 2.06% |
| due to underinflation | 1.16% | 0.58% | 2.32% |
| due to overinflation | -0.13% | -0.07% | -0.26% |

Note: updated table above (compared to version 02 of the document).

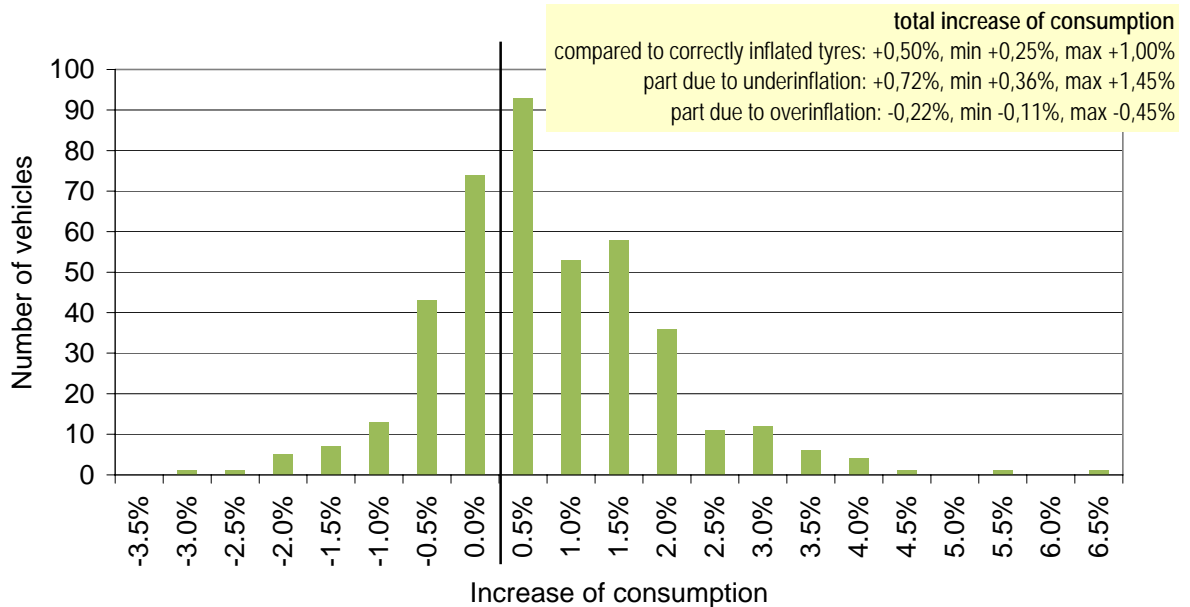
Calculation Method 2

Dutch analysis of 2010 vehicles concerning tyre inflation



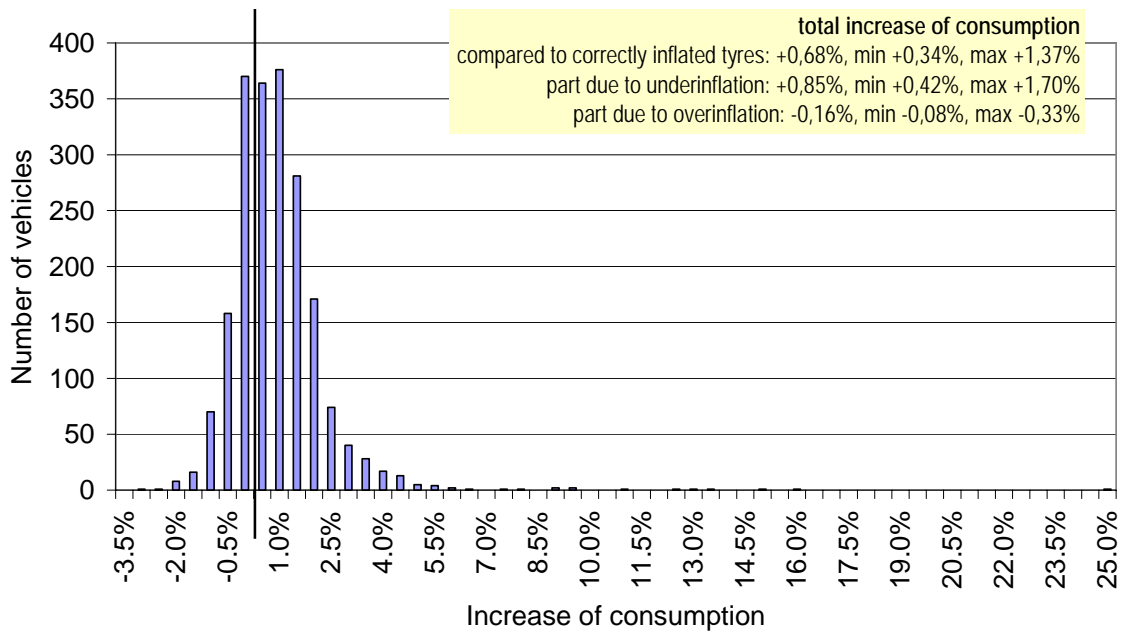
Note: updated graph above (compared to version 02 of the document).

Japanese analysis of 420 vehicles concerning tyre inflation



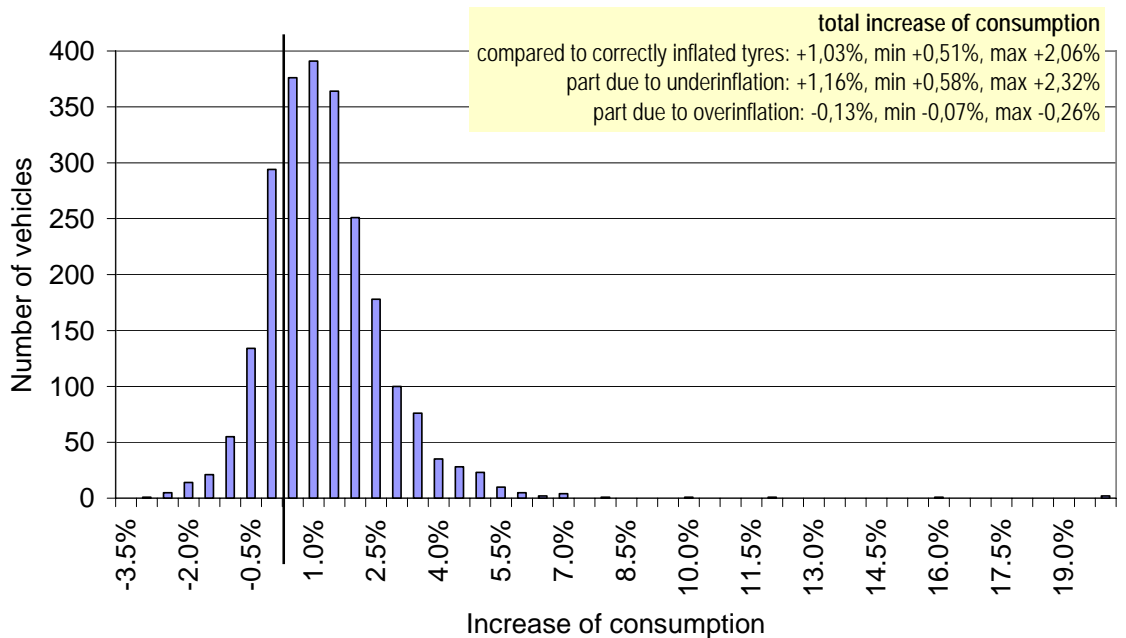
Note: updated graph above (compared to version 02 of the document).

F analysis of 2013 vehicles concerning tyre inflation



Note: added graph above (compared to version 02 of the document).

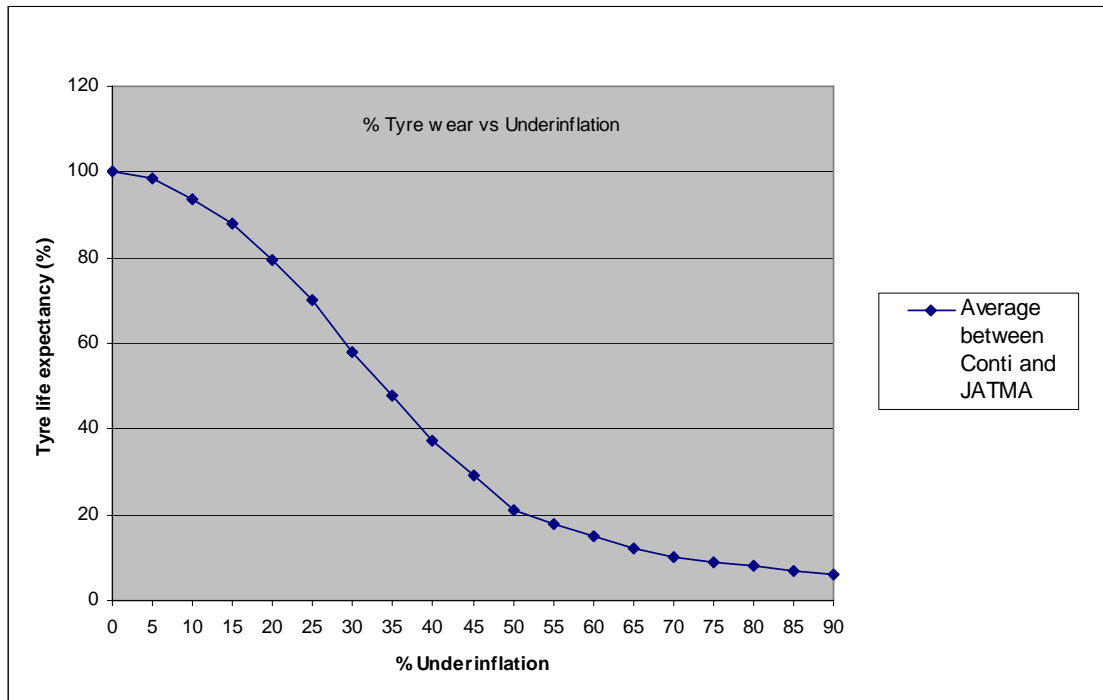
UK analysis of 2373 vehicles concerning tyre inflation



Note: added graph above (compared to version 02 of the document).

2.2. Tyre wear

The TFG confirms the following graph based on the available data:



Using the above formula on the selected data sets of paragraph 1 gives the following tyre wear increase:

| Tyre wear increase summary | Total |
|-----------------------------|---------------|
| Dutch survey (%) - 4 wheels | 8.17% |
| Japan survey (%) - 4 wheels | 8.01% |
| UK survey (%) 4 wheels | 16.06% |
| France survey (%) 4 wheels | 11.82% |
| <i>Average</i> | <i>11.02%</i> |

Note: updated table above (compared to version 02 of the document).

2.3 Road safety

The available data has a lot of variation depending on the country, the source etc. which makes it difficult to draw conclusions.

The TFG roughly estimates that:

- 0.1% to 1% of fatal accidents in Europe are caused by under inflation
- 0.1% to 1% of accidents having generated injuries in Europe are caused by under inflation

3. Causes of under-inflation

3.1. Tyre permeation

Taking into account the available data, the TFG concludes that the tyre pressure loss due to tyre permeation varies between 0.07 bar and 0.2 bar per month.

3.2. Other causes

The tyre pressure will also be reduced to other factors such as punctures (nails), damaged rims, leaky valves etc. The TFG concludes that the tyre pressure loss due to these miscellaneous factors can vary from 0.1 bar per month up to 0.1 bar per minute.

3.3. Control of tyre pressure

Taking into account the available data, the TFG concludes that 70% to 89% of the drivers admit they don't check their tyre pressure

SECTION B: Commercial Vehicles (CV)

The group agrees to focus as a first priority on PC, and confirms that CV remain within the scope of work of the task force and will be analyzed in a second step.