Management methodology in Technosphere safety

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POLYTECH

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Technosphere

The **anthroposphere** (sometimes also referred as **technosphere**) is that part of the environment that is made or modified by humans for use in human activities

Technosphere Safety in Russia

- Labor safety
  - Occupational safety and health
  - Assessment of working conditions
- Safety management
  - Industrial Safety
  - reliability of technical systems and industrial risk
  - Safety Oversite
- Fire safety
- Ecological safety
- Emergency safety
  - Natural and man-made disasters

Unified technology

Main idea:

the results of decisions taken do not justify the expectation of a person. An unsatisfactory result of management is justified by contradictory conclusions.

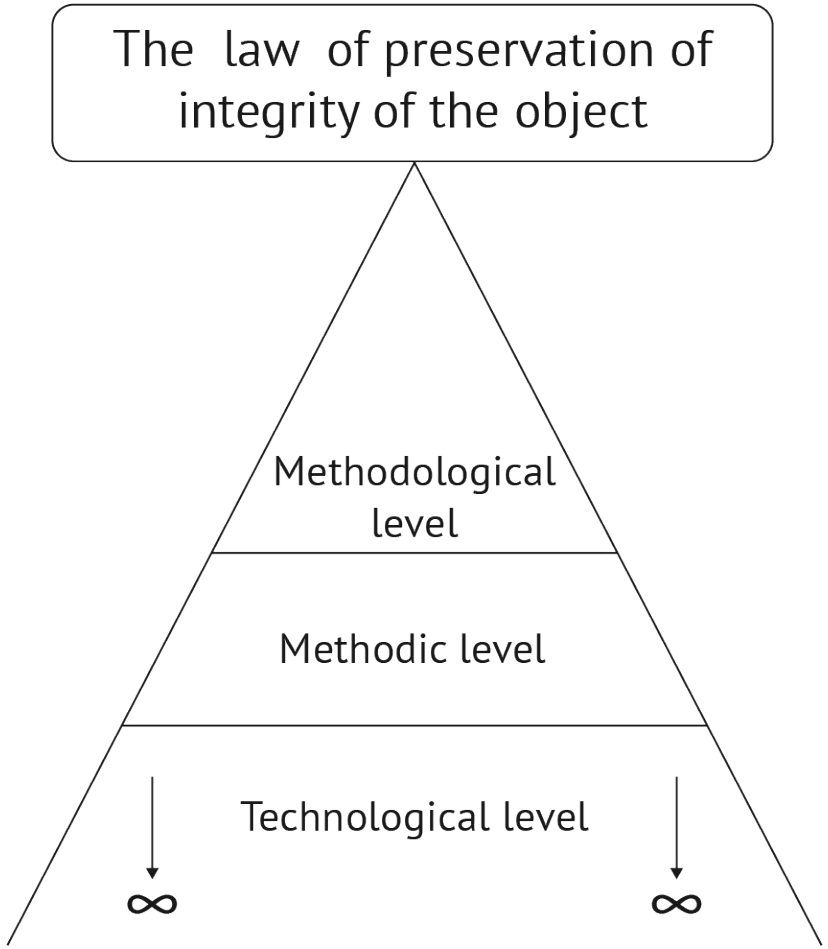
The axiomatic method

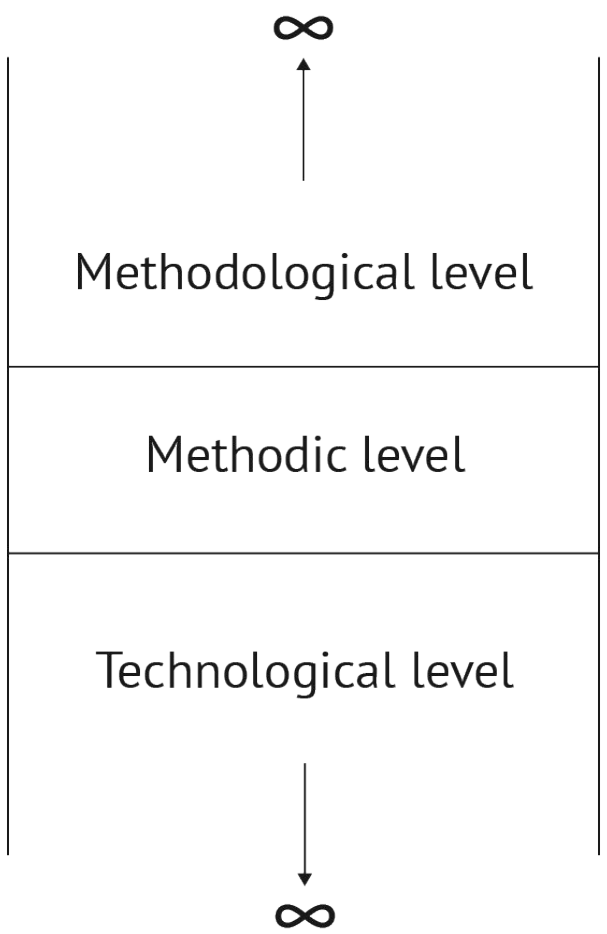
1. Basic assumptions and assumptions, usually expressed in basic principles.
2. Basic concepts, key words, axiom; rules of withdrawal; theory.

For objective use of this method, it should be noted that in the process of participating

1. A man, his consciousness.
2. The world around (object).
3. Something that is given by nature and allows for cognition.

The main process of a complex system





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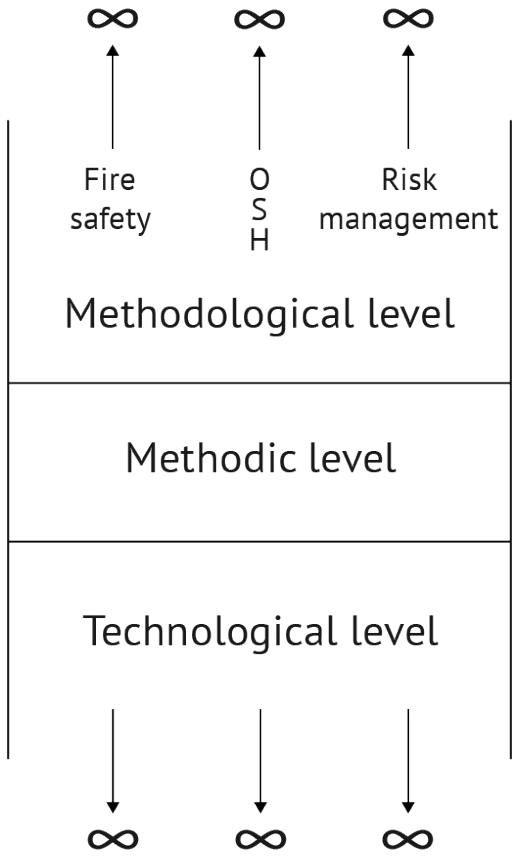
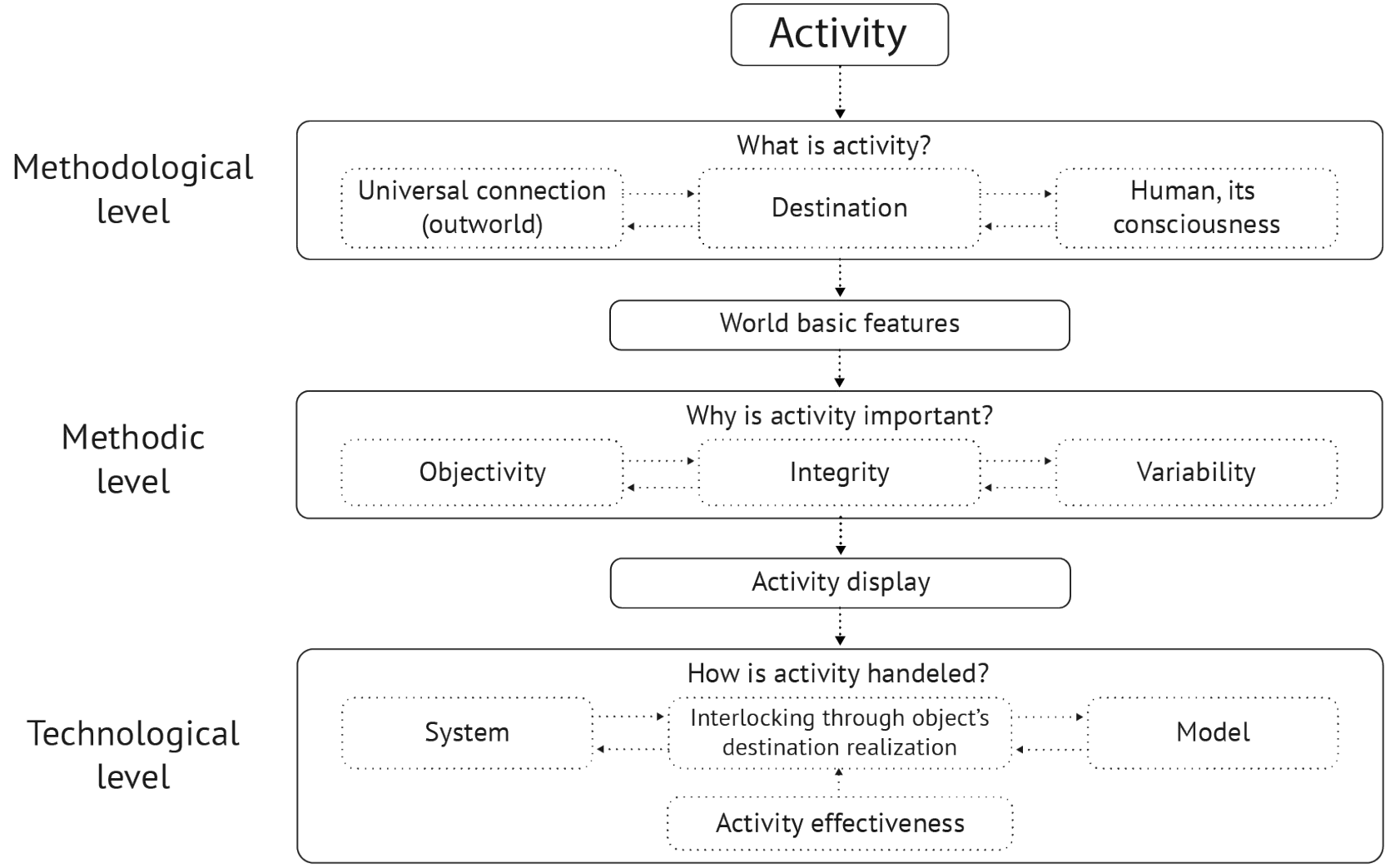
Example



Lack of a unified methodology leads to contradictions

Natural-scientific approach



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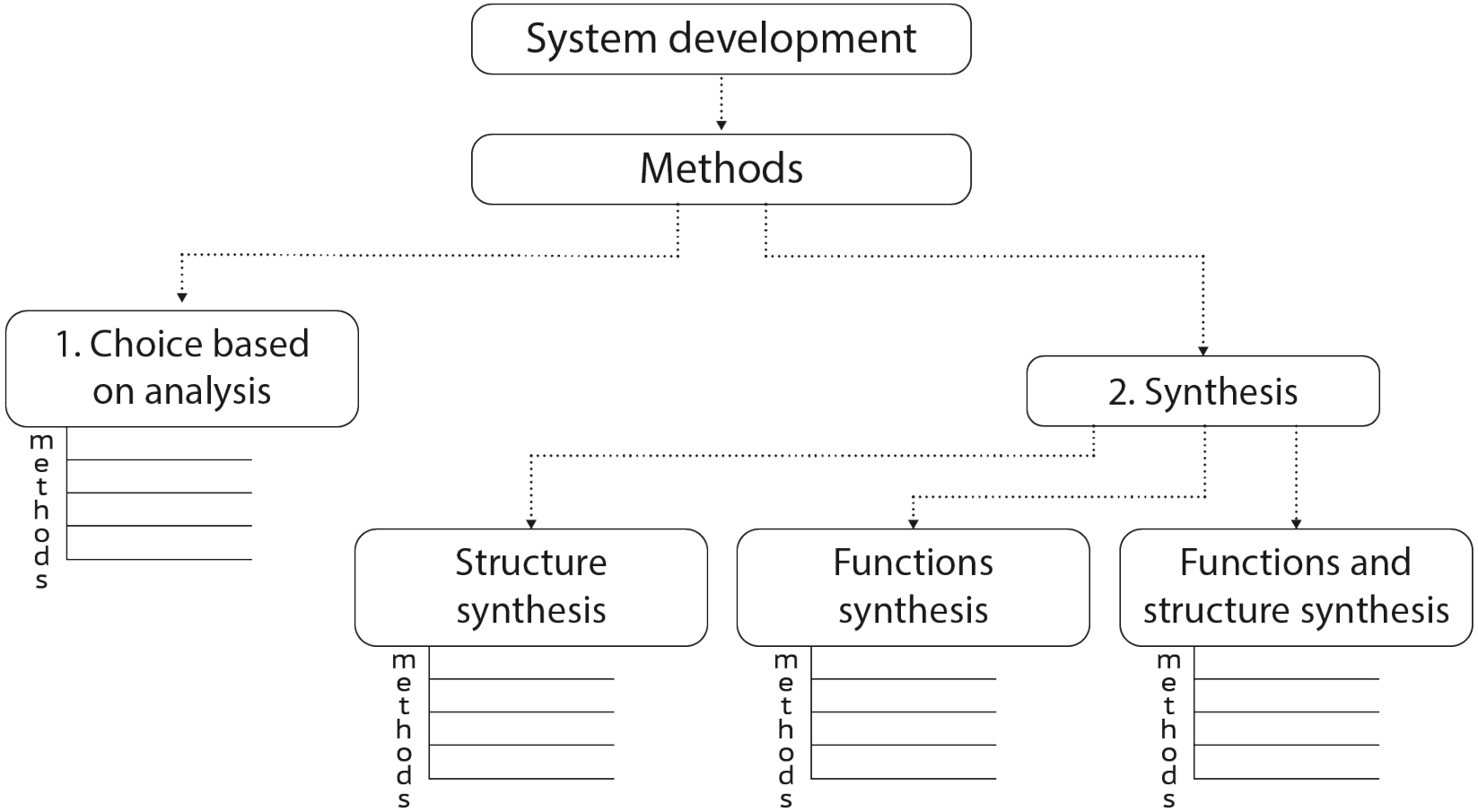
Main directions of system development



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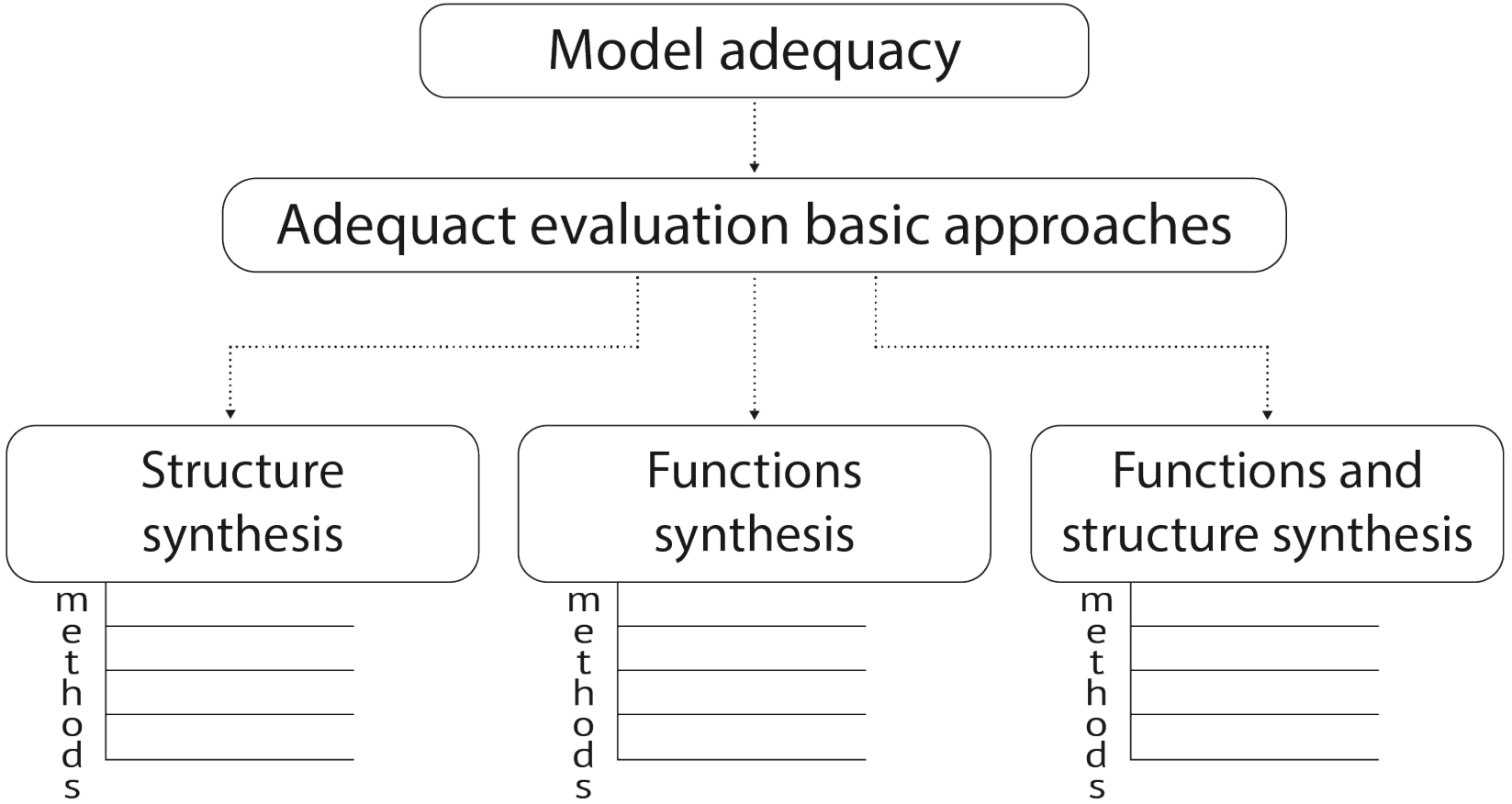
System development

- Direct problem - analytical, based on solving the problem in the form of analysis.
- Inverse problem - synthetic, based on the solution in the form of synthesis

Therefore, in the present work, the solution is used for the synthesis

Main directions for assessing the adequacy of the model



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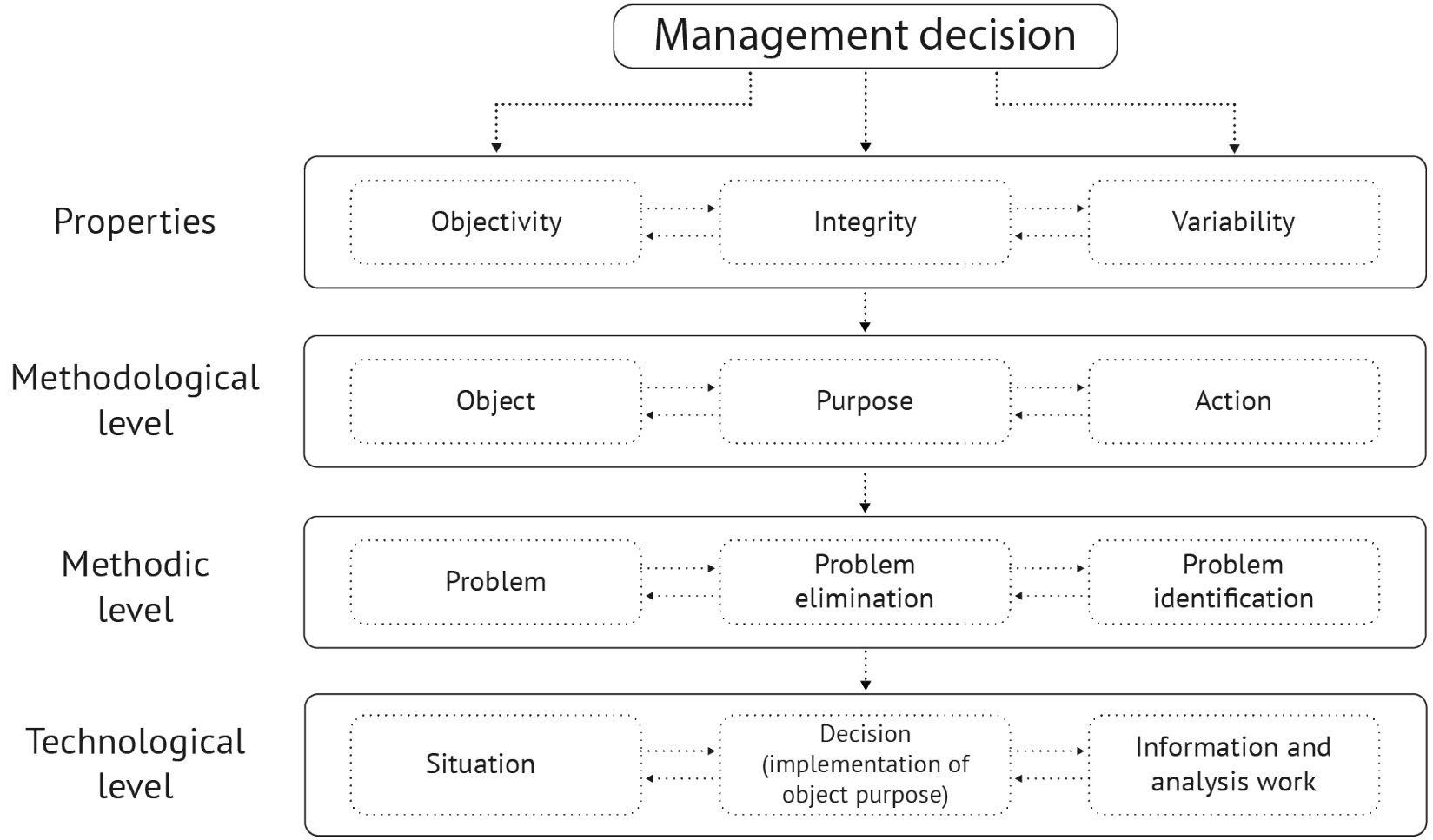
Management decision – Solution



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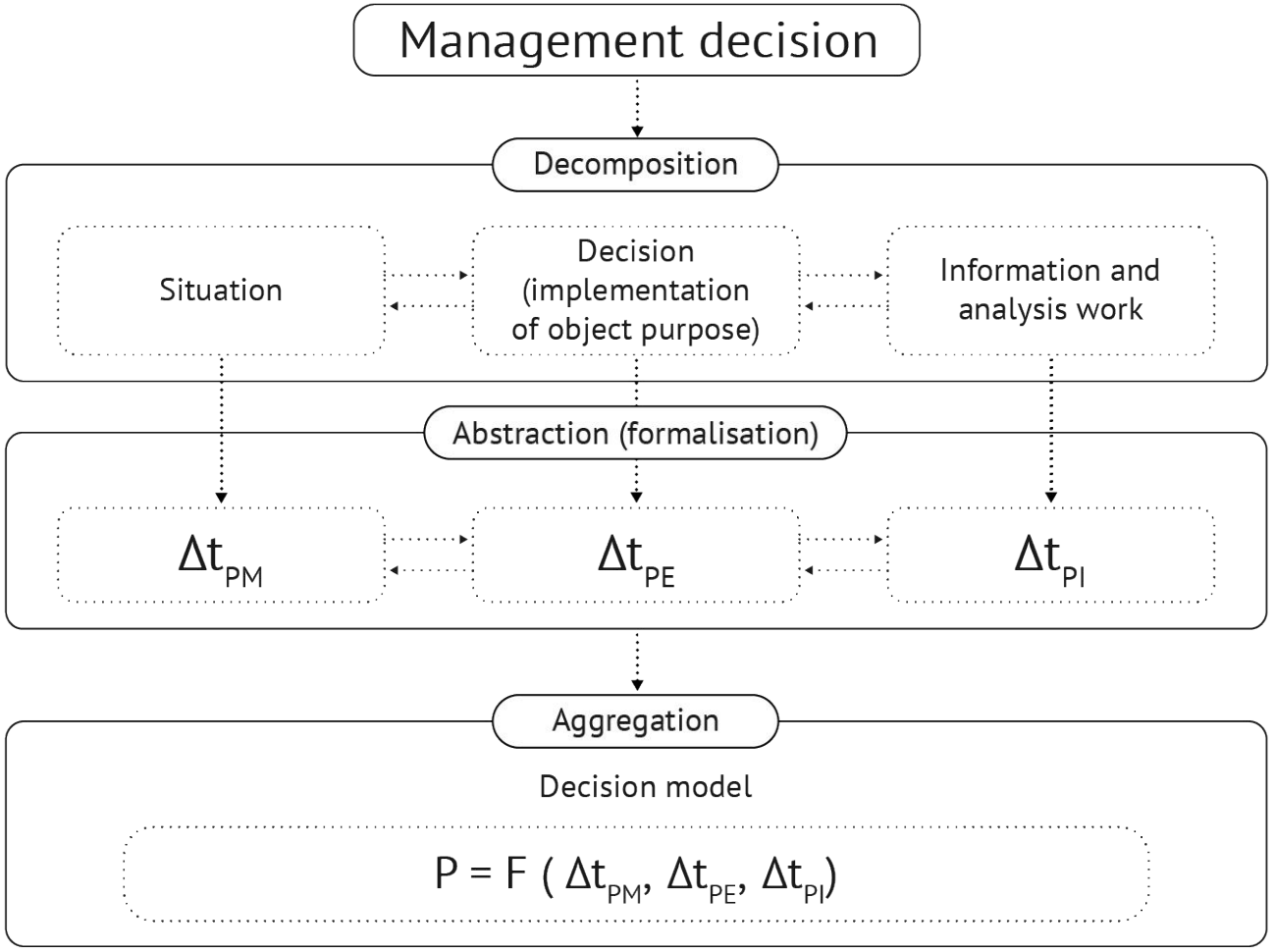
Mathematical model of the solution



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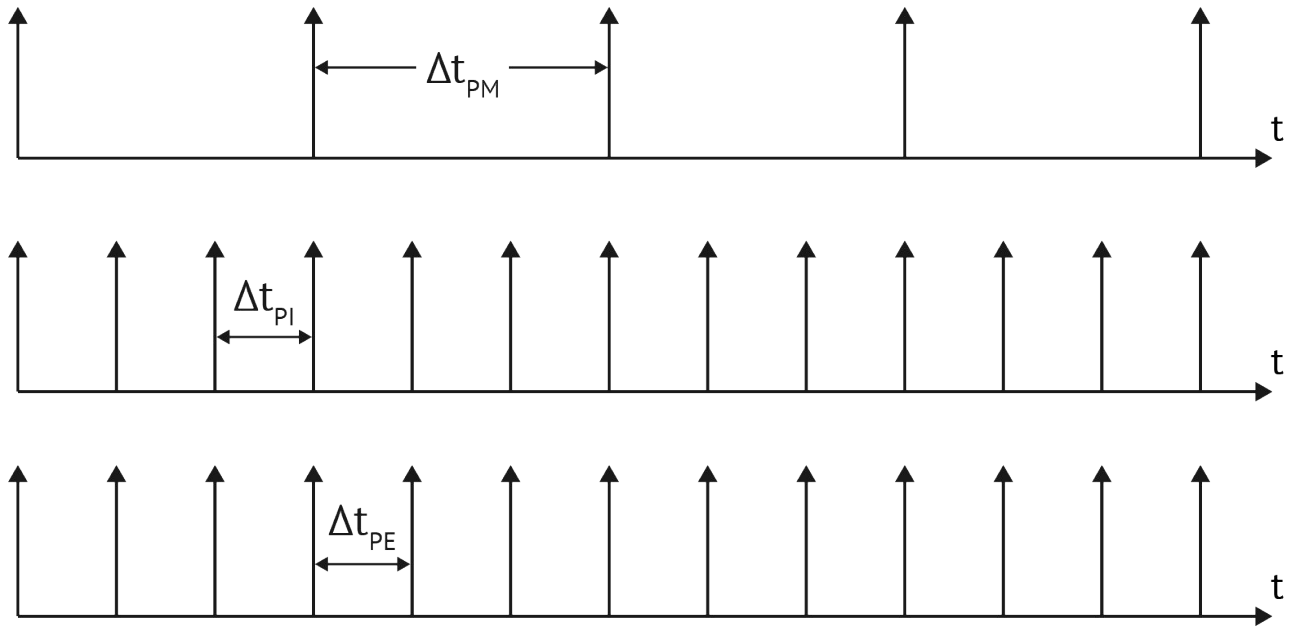
Basic elements of the formation of the decision model

- Δt_{PM} - the periodicity of the problem manifestations
- Δt_{PE} - the periodicity of the problem neutralization
- Δt_{PI} - the periodicity of the problem identification



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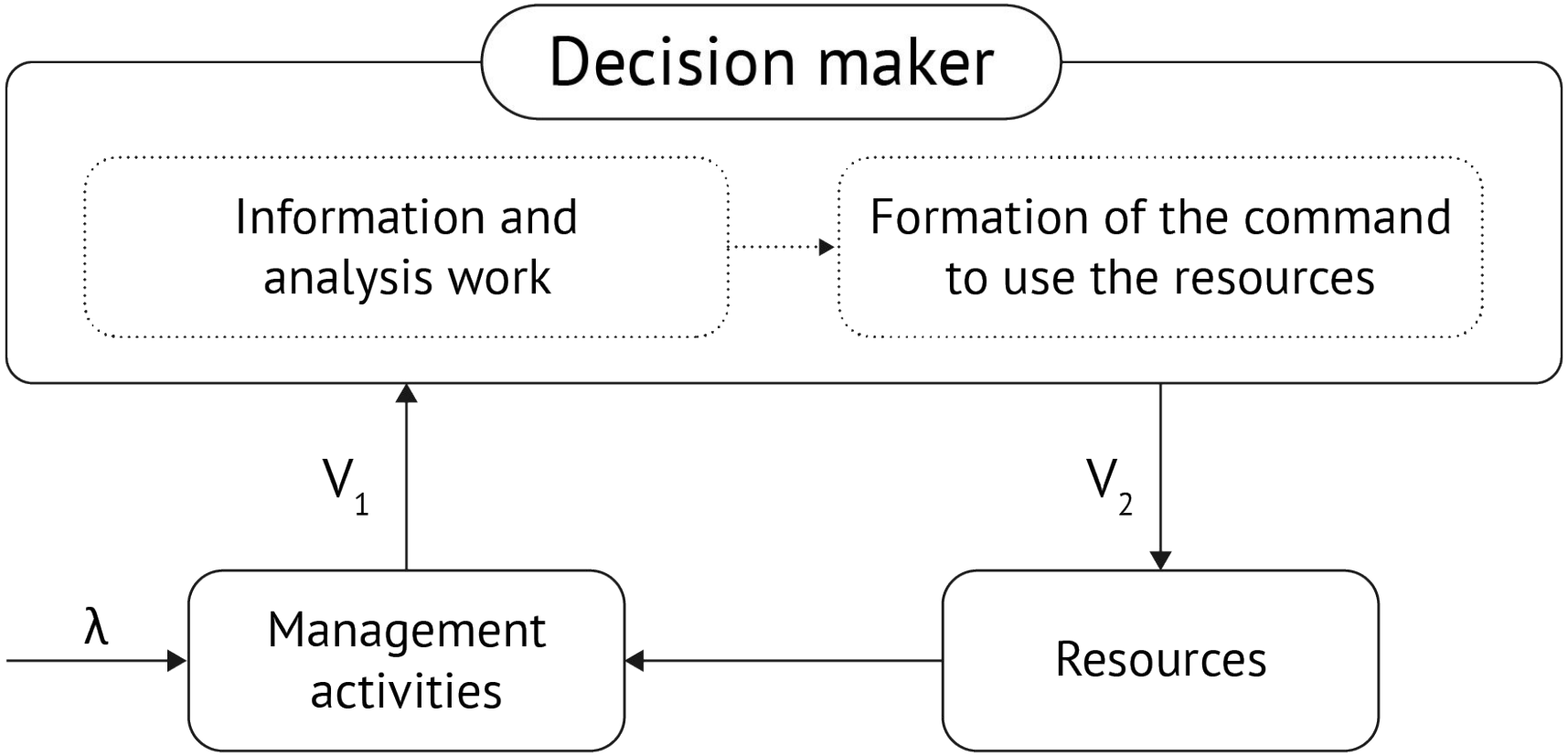
Process intensity

- $\lambda = 1/\Delta t_{PM}$ - the periodicity of the problem manifestations
- $v2 = \Delta t_{PE}$ - the periodicity of the problem neutralization
- $v1 = 1/\Delta t_{PI}$ - the periodicity of the problem identification

$$P = F\left(\Delta t_{PM},\ \Delta t_{PE},\ \Delta t_{PI}\right)$$

Decision maker



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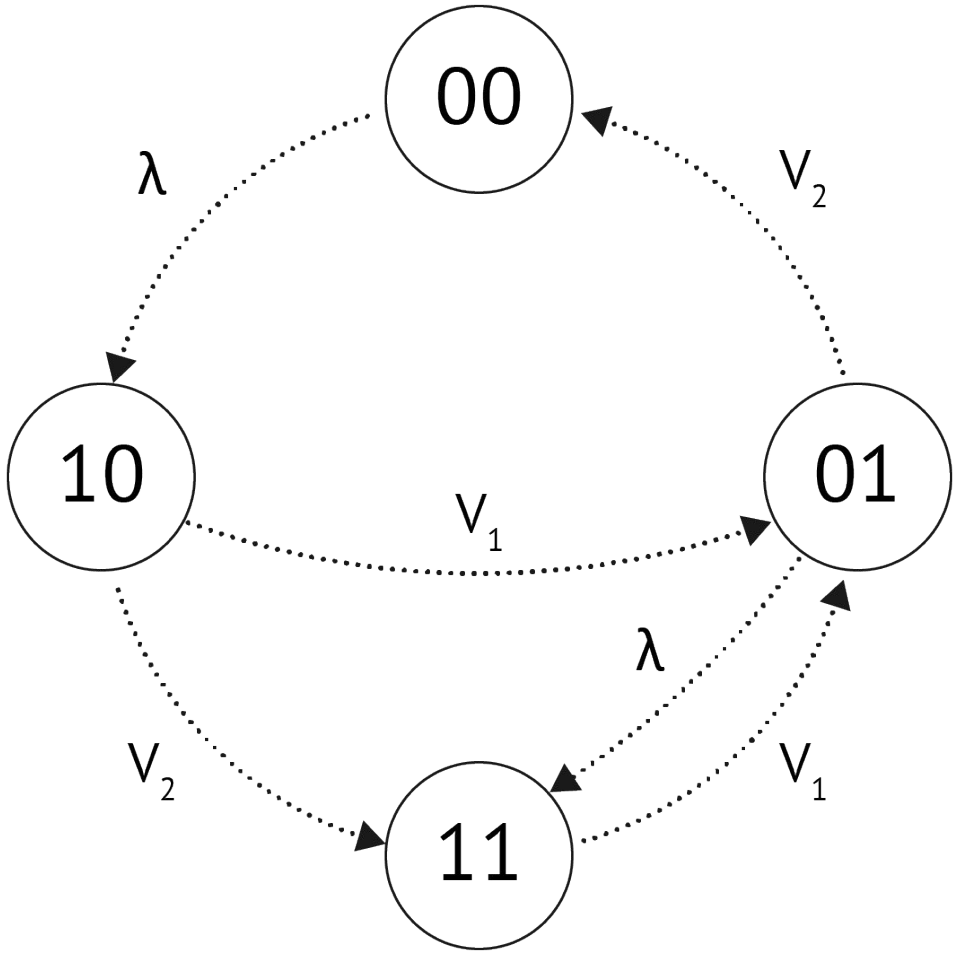
Process of forming the management decision



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Basic states of solution

- A_{00} - does not identify or neutralize;
- A_{10} - identifies and does not neutralize;
- A_{01} - does not identify and neutralize;
- A_{11} - identifies and neutralizes.

Solution of Kolmogorov-Chapman system

- In this relationship, three parameters (λ; v1; v2) are associated with the level of the safety management
- Safety indicator

$$P_{00} = P_{INP} = \frac{V1\ V2}{\lambda(\lambda+V1+V2)+V1\ V2}$$

Technology features

Safety indicator allows you to assess changes in the situation in any area of public safety

Road safety

- λ = V/30

  V– speed, 30 m – distance to pedestrian crossing

- v1 = 1/x = 5

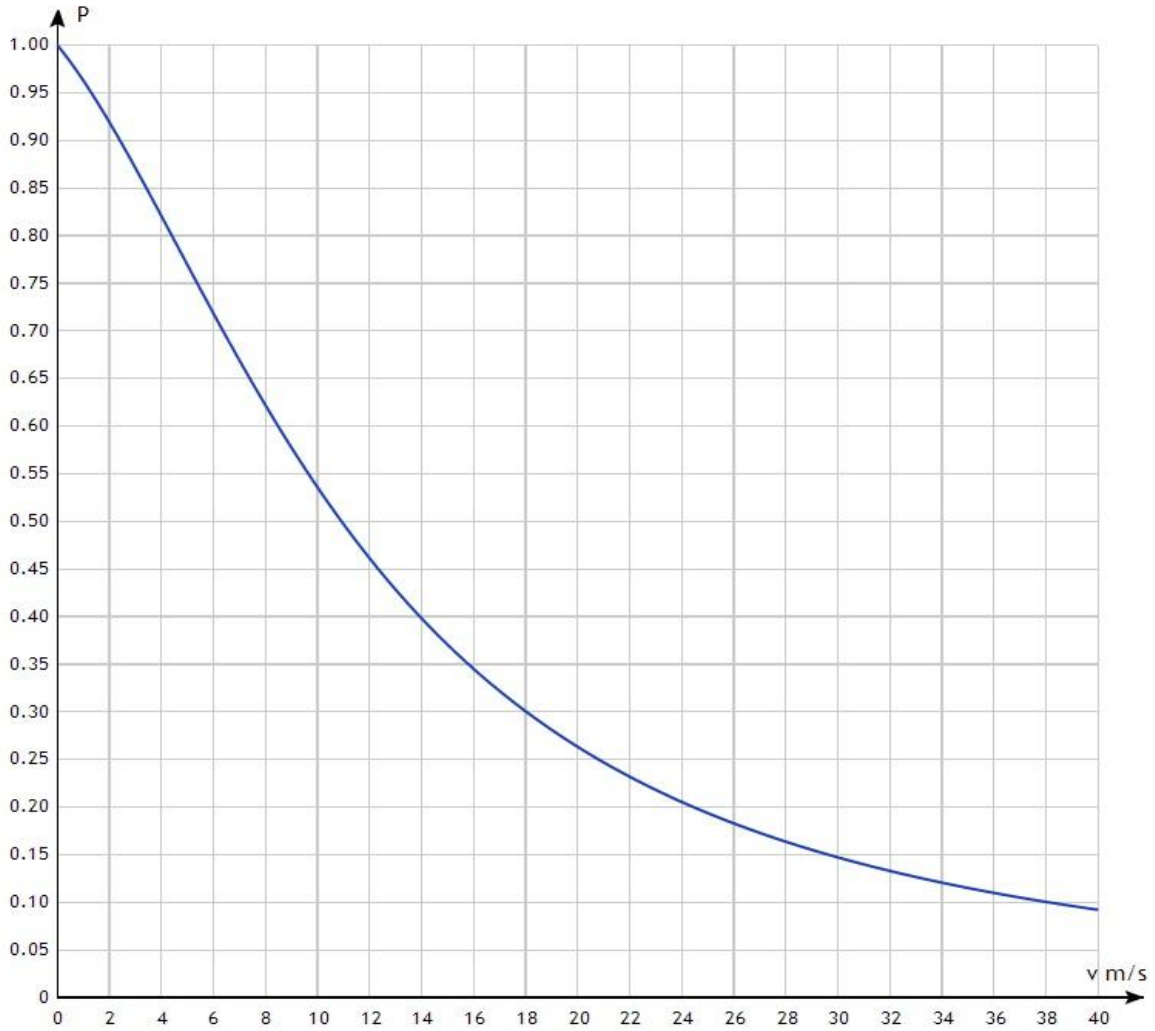
  x - human response time to visual signal 0,2 - s

- v1 = 1/y = 1.25

  y - driver response time (start of braking) – 0.8 s

Road safety

$$\dot{P}_{00} = \frac{187,5}{V^2+6,25V+187,5}$$



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Road safety

- The graph shows the dependence of the safety indicator (when the driver has time to brake) on the speed of movement
- It is possible to calculate which speed control method (speed bump, visual cues or similar) gives the best safety level

Worker safety

Currently, we are considering possible threats to the most important professions.

- Firefighter Safety
- Builder Safety
- …

Conclusion

Accounting for scientific laws while ensuring safety according to a unified methodology allows calculating the safety indicator

Development a system based on solving the inverse problem allows you to avoid contradictions in safety ensuring