FISITA WORLD AUTOMOTIVE CONGRESS

F2014-LWS-040

TSI NNSTU

The Russian Federation
Nizhny Novgorod State Technical University named after R.Y. Alekseev
Transport Systems Institute

Modeling of Roads Impacts for Life Prediction of Light Commercial Vehicles Parts

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Cooperation between NNSTU and GAZ
Governmental support of R&D

NNSTU – the best traditions of Soviet and Russian engineering school

GAZ – Russian producer of LCV

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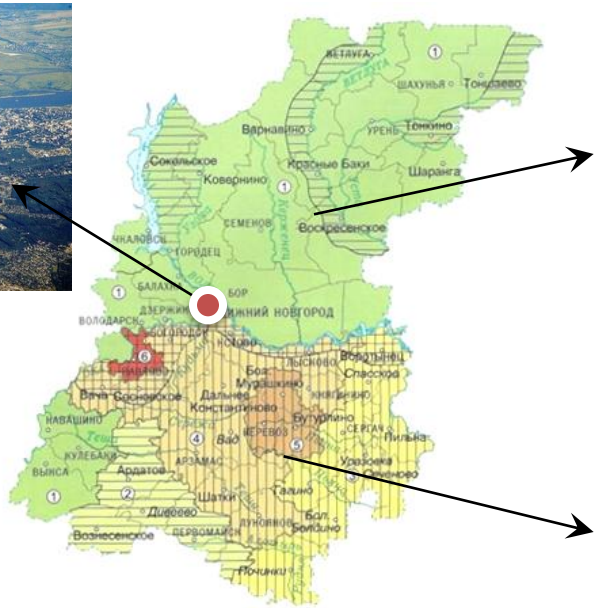


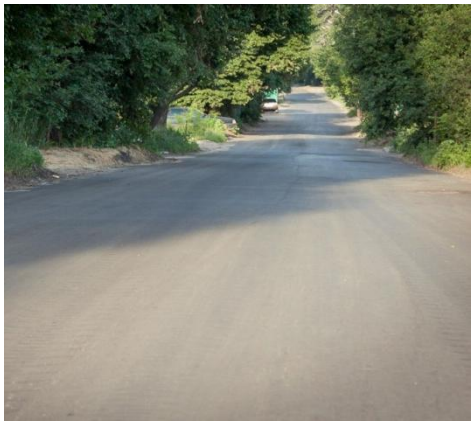
Nizhny Novgorod Region

Level road

Hilly country road

№	Characteristics of a road
1	Road in good condition
2	Little worn road
3	Badly worn road
4	Broken road

Characteristics of a road



1 Road in good condition

2 Little worn road

3 Badly worn road

4 Broken road

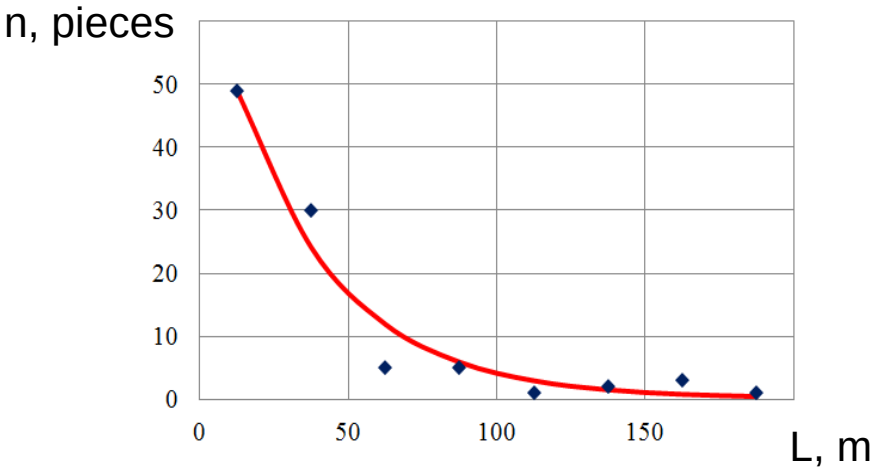
Experimental research

Typical road sections

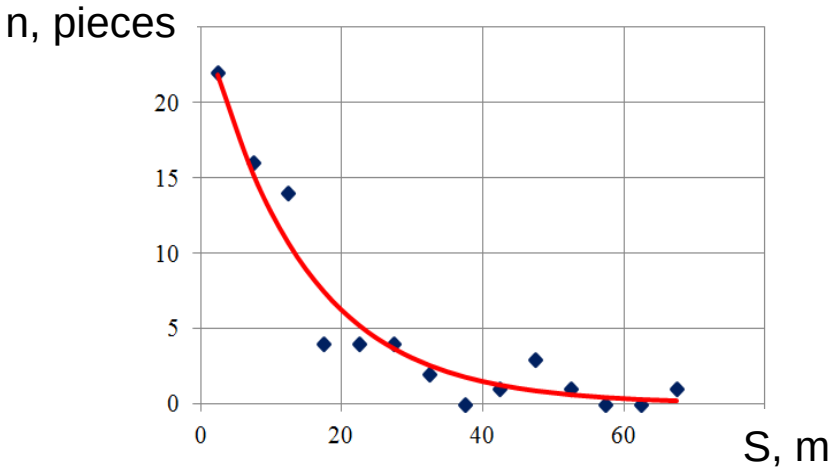
Road microprofile

Vehicle and test equipment

Experimental research



Distribution of roughness length (road 2)



The length of roughness “wavelength” (road 2)

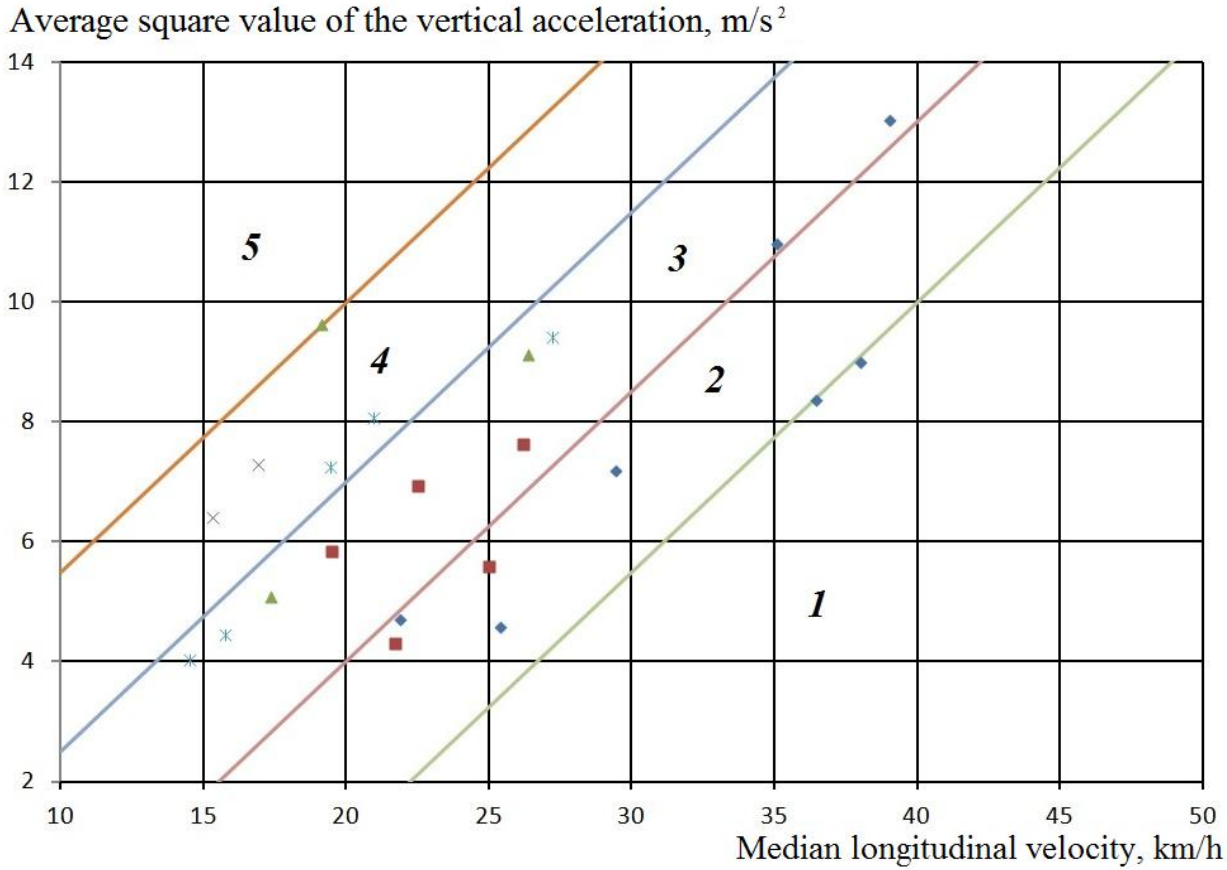
Road roughness
The exponential law of distribution

$$n(x) = \begin{cases} A \cdot \frac{1}{\lambda} e^{-\frac{x}{\lambda}} & if \quad x \geq 0, \\ 0 & if \quad x < 0, \end{cases}$$

where $A = a \cdot \Delta x$, $A, a > 0$ – parameters of this distribution, Δx – discretization step of sizes of roughnesses, a and λ – empirical coefficients.

№	Characteristics of a road	Type of roughness	Size parameters		Distance settings		The average depth of roughness, cm
			a	λ	a	λ	
1	Road in good condition	Potholes	-	-	-	-	-
		Cracks	-	1	180	5	-
2	Little worn road	Potholes	185	15	100	15	1
		Cracks	-	2	120	5	-
3	Badly worn road	Potholes	100	45	110	6	2
		Cracks	-	3	60	5	-
4	Broken road	Potholes	190	150	190	5	3

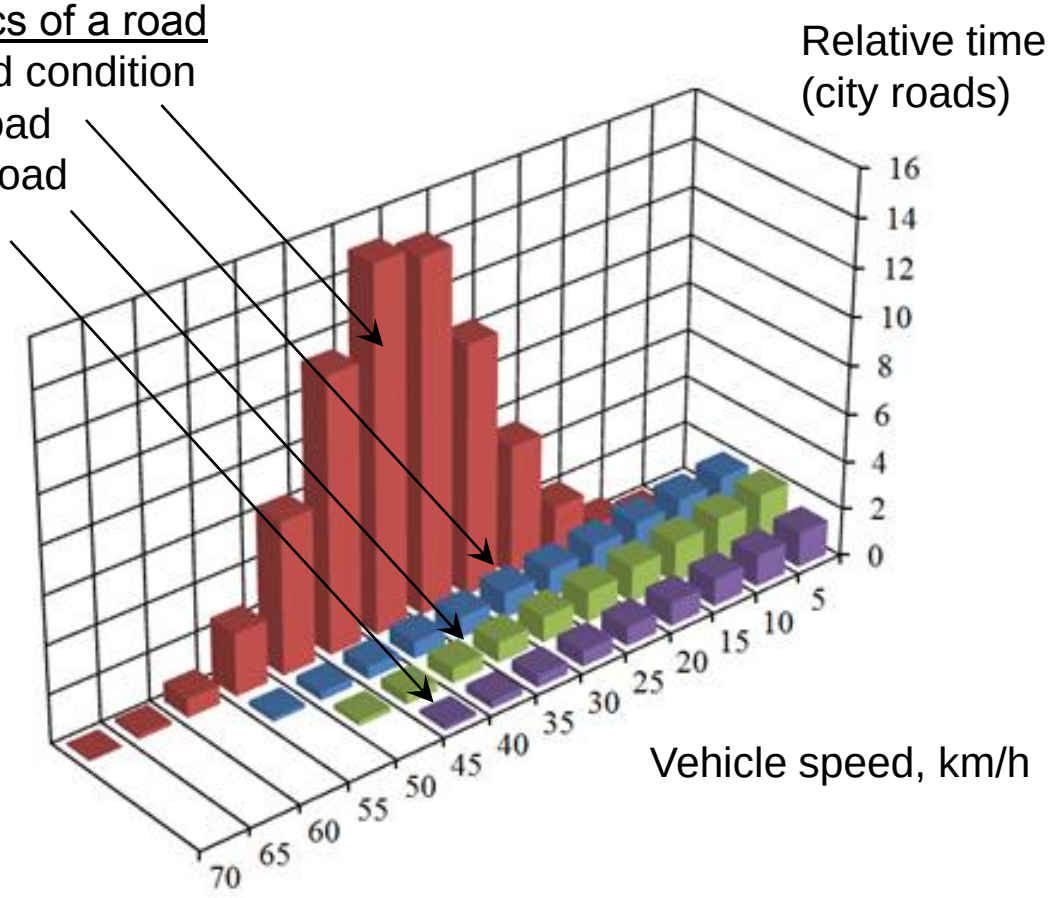
The influence of the vehicle speed on the vertical acceleration of the unsprung mass



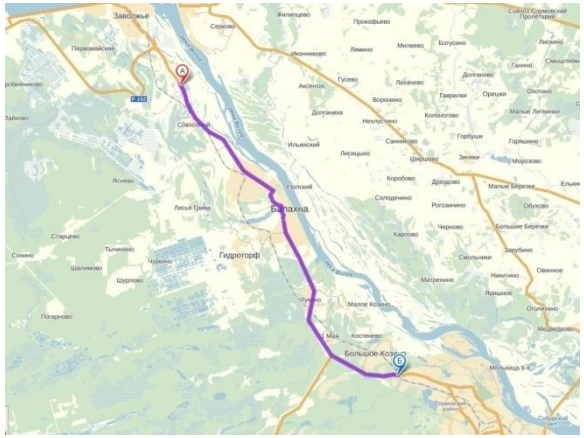
1 - Road in good condition, 2 - Little worn road, 3 - Badly worn road,
4 - Broken road, 5 - Elements of the road network (tram tracks, crossings, etc.).
The dots show the experimental data

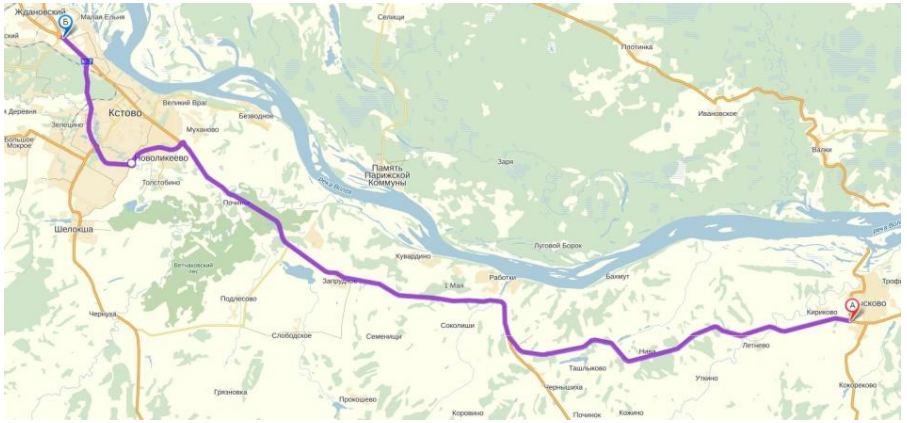
Relative time of “road action”
Relative daily run

№	Characteristics of a road
1	Road in good condition
2	Little worn road
3	Badly worn road
4	Broken road



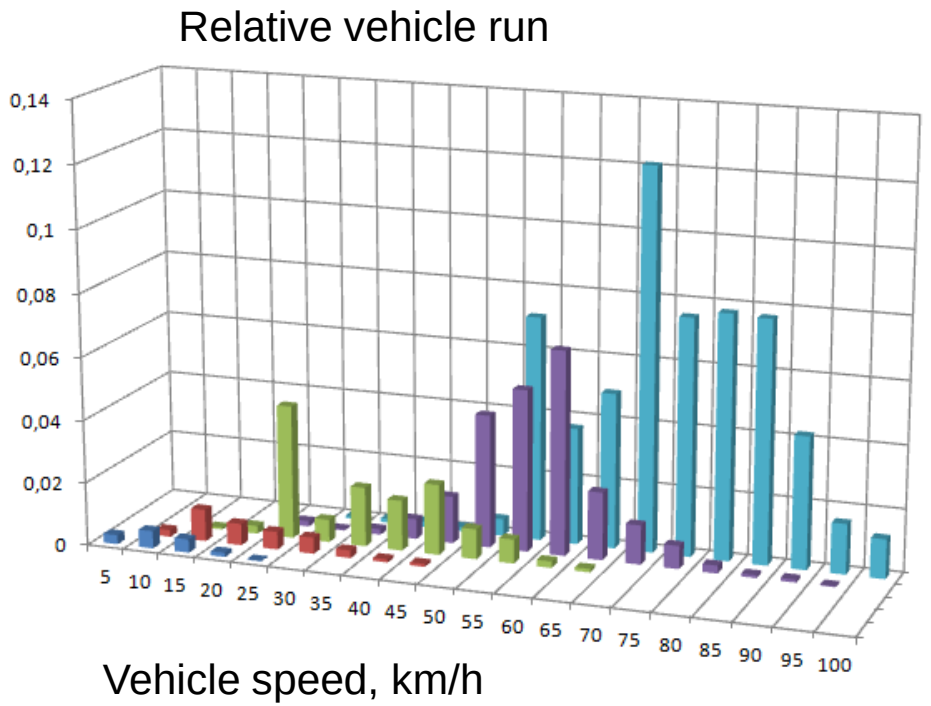
Road route data

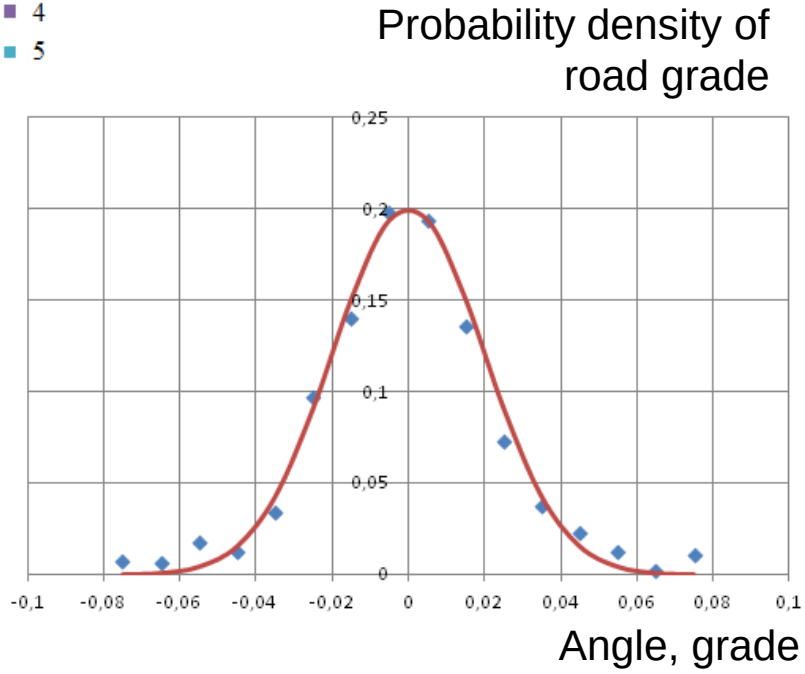




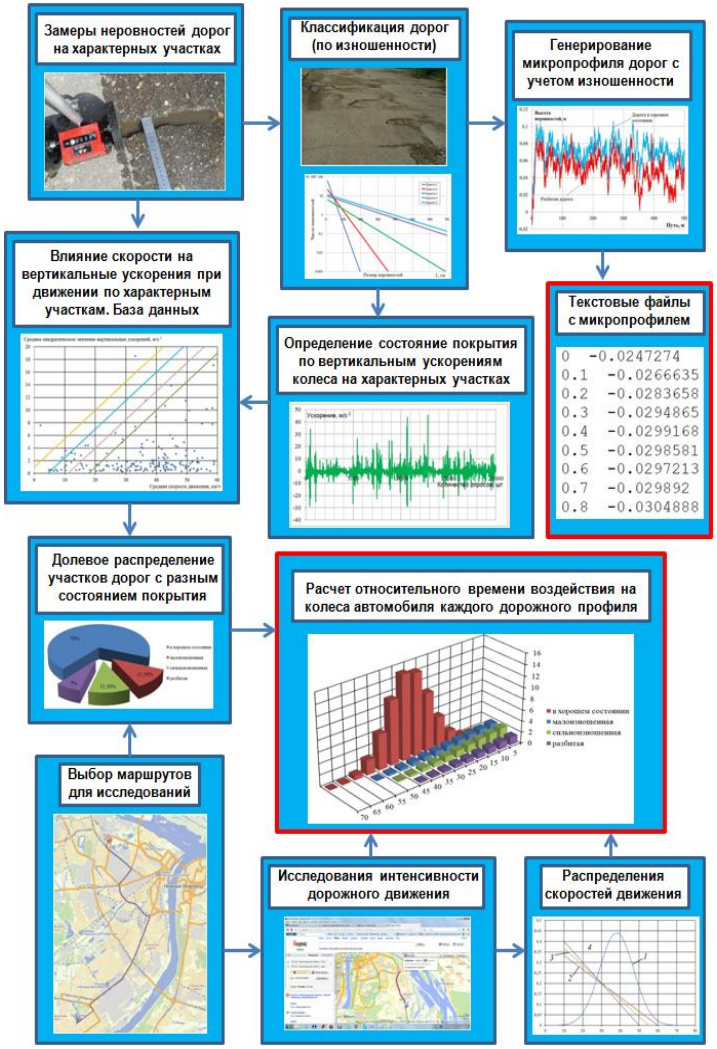
The length of the route: 60…100 km

Relative vehicle run
Probability density of road grade





Conclusions



1. Methodology of simulation of the impacts from road surface was proposed.
2. The set of initial data for simulating of the loading history of LCV was collected.
3. A search for ways to determine the statistical distribution of velocities of LCV in the conditions of suburban roads taking into account the traction and speed characteristics of vehicles and parameters of macrorelief (distribution of longitudinal slopes) was carried out.
4. Is currently underway to find ways to further account of the basic elements of the road network (tram tracks, crossings, etc.) when generating the ordinates of a microprofile.

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Thank you for attention!

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