Effectiveness of the steel mesh track in repairing asphalt pavements in Małopolska region

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Effectiveness of the steel mesh track in repairing asphalt pavements in Małopolska region

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Abstract. The aim of this publication is to present and evaluate the effectiveness of the steel mesh track during reconstruction of the pavement on national roads in Małopolska. The paper presents the condition of the pavement before reconstruction, applied design solutions and the current state after 6-10 years of operation. To assess the effectiveness of pavement reinforcement, the results of central deflection tests using the FWD apparatus before and a few years after the reconstruction were compared, it was found that the reinforcement effect was achieved, what has been demonstrated by means of significance analysis of differences in Statgraphics program. Additionally the analyses were extended with parameters characterizing the FWD deflection basin. For selected parameters the values of tensile strains at the bottom of asphalt layers were determined on the basis of correlations given in literature and then the fatigue life was calculated using the criteria of the USA Asphalt Institute and compared with the results of design calculations. The pavement fatigue life estimated on the basis of FWD measurements is generally greater than the one calculated for the design solutions. The assessment of the influence of the steel mesh track on the bearing capacity of the pavement was carried out indirectly, by comparing the central deflections of the structures measured after the reconstruction, with theoretical deflections calculated using the pavement model in the BISAR program, without taking into account the presence of the steel mesh. In some cases the deflections measured are significantly smaller than the deflections calculated for the model without mesh, which can be explained by the reinforced effect of the steel mesh track, especially for sections with the lowest bearing capacity before reconstruction, and where the steel mesh track is placed in the tension zone of the asphalt layers.

1. Introduction

Geosynthetics and related products, such as steel mesh track, have been used in asphalt repairs for over 30 years. The basic functions of these products are delaying reflected cracks, waterproofing the surface and strengthening the asphalt layers. Studies on the effectiveness of using these materials in repairs of asphalt pavements were the subject of many publications, however, most of these works relating to laboratory tests, i.e. works conducted in Belgian Road Research Centre in Brussels [1] show that steel nets are the most effective materials used as stress relieving layer, delaying the reflective cracking propagation in the semirigid asphalt pavements. Computer finite element modelling of asphalt pavement with steel wire grid was performed by Hohamady at al [2], the results show that the performance of steel mesh reinforced sections is better than that of geosynthetics grid reinforced sections and almost close to rigid section. In addition, the above studies confirmed the results of earlier works [3], [4], that the best location of reinforcement is at the bottom of asphalt layers. Testing of the different interlayers on real road sections [5] confirmed the best performance in delaying reflective cracking by glass fibre grid and steel mesh track, other types of intermediate layers have proved less effective. Similar results were achieved in Portuguese research [6], where steel mesh with slurry seal had the best performance, and the bitumen impregnated geotextile sections were the second best.

Initial tests of the efficiency of steel mesh tracks in the reinforcements of asphalt pavements in Małopolska have already been studied on the example of 5 sections, the results were published at the CETRA 2016 Conference Proceedings [7]. Condition of pavements of all analysed road sections after several years of exploitation is very good. No damages were observed, what confirms the effectiveness of applied solution. Bearing capacity of the tested sections evaluated according to the pavement condition evaluation system, i.e. DSN [8], classifies all road tested sections in class A, what means that the remained fatigue life is equal to minimum 20 years. Increase of the bearing capacity of reinforced pavements evaluated with the FWD method for all sections is very substantial. Central deflection values measured on the pavements reinforced with the steel mesh track and adjusted to static load conditions are lower than deflections calculated with BISAR program for the pavement structure without the steel mesh. The differences are substantial for 2-3 out of 5 tested sections, depending on the assumed significance level 95% or 90 %. The best effectiveness of the steel mesh applying is observed for the sections where the bearing capacity before rebuilding was the lowest, and where the steel mesh is placed in the tension zone.

In the present paper, the scope of the analyzed sections was enlarged by 3 additional ones, and the analyses were extended with additional parameters characterizing the FWD deflection basin, such as SCI, BDI, BCI, AUPP and AREA. For selected parameters, i.e. BDI and AUPP, the values of tensile strains at the bottom of asphalt layers were determined on the basis of correlations given in [9] and [10] and then the fatigue life was calculated using the criteria of the USA Asphalt Institute [11] and compared with the results of design calculations.

2. Test program

For the assessment, several road sections were selected, which before the reconstruction were characterized by poor technical condition of the pavement. Depending on the section, the following failures were found: ruts, corrugations, single and alligator cracks, reflected transverse cracks, patches and potholes.

The test program includes:

- Characterization of surface condition before reconstruction, i.e. testing the bowl of dynamic deflections using Falling Weight Deflectometer - FWD (sections 1, 2 and 3 for DK94 and section 5 for DK4) or static deflections using the Benkelman Beam (section 6 for DK28 and sections 4 and 7 for DK44) as well as visual assessment of the surface condition;
- Description of the applied design solutions and calculations of the pavement structure fatigue life;
- Assessment of the pavements condition a few years after the reconstruction, including the measurement of the dynamic deflection basin with the use of FWD as well as visual assessment, evaluation of the pavement bearing capacity according to DSN system [8], comparison of the central deflections of pavement measured before and after the reconstruction with theoretical values calculated acc. to design solutions, application of statistical tests to access the significance of differences;
- Evaluation of the deflection basin parameters before and after the reconstruction, e.g. SCI, BDI, BCI, AUPP and AREA with statistical evaluation of the significance of differences, then calculations of the tensile strains at the bottom of asphalt layers acc. to literature correlations and finally determining the fatigue life of the pavement based on the calculated values along with the comparison with the results obtained at the design stage;
- Discussion of the results and formulation of the conclusions.

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3. Results

3.1. Characterization of road sections

The road sections selected for the tests were typical flexible structures with asphalt layers on granular base. All sections before rehabilitation were submitted to the diagnostic tests of their conditions then the existing pavement structures as well as subgrade were identified.

The list of the analyzed road sections with layers thicknesses (H) measured on pavement cores and layers stiffness modulus (E) determined from the FWD back analysis and converted to static load condition and the equivalent temperature of +20°C acc. to Catalogue [12] are given in Table 1. Sections No. 1÷4 were already partially analyzed before [7], while sections 5-7 have not been analyzed so far.

Table 1. Summary of the analyzed sections of roads.

Road number	Section	Chainage		Asphalt layers	Aggregate subbase	Subgrade
94 - roadway right	1A	285+488 286+300	÷	H= 28 cm E=4111 MPa	H=17 cm E=165 MPa	H=infinity E=92 MPa
	1B	286+300 287+450	÷	H= 28 cm E=3855 MPa	H=31 cm E=370 MPa	H=infinity E=71 MPa
	1C	287+450 288+320	÷	H= 26 cm E=3349 MPa	H=51 cm E=159 MPa	H=infinity E=73 MPa
94 - roadway left	2A	285+488 286+650	÷	H= 22 cm E=3580 MPa	H=40 cm E=308 MPa	H=infinity E=84 MPa
	2B	286+650 287+870	÷	H= 22 cm E=2726 MPa	H=47 cm E=249 MPa	H=infinity E=76 MPa
	2C	287+870 288+320	÷	H= 25 cm E=6594 MPa	H=47 cm E=240 MPa	H=infinity E=132 MPa
94	3	305+100 307+100	÷	H= 21 cm E=3000 MPa	H=29 cm E=400 MPa	H=infinity E=108 MPa
44	4	101+900 102+900	÷	H= 17 cm E= 2000 MPa	H=40 cm E= 200 MPa	H=infinity E= 58 MPa
4	5	482+800 483+900	÷	H= 31 cm E=2000 MPa	H=70 cm E=220 MPa	H=infinity E=75 MPa
28	6	142+070 146+530	÷	H= 20 cm E=2000 MPa	H=100 cm E=100 MPa	H=infinity E=40 MPa
44	7	58+500 61+100	÷	H= 15 cm E= 1500 MPa	H=45 cm E= 182 MPa	H=infinity E= 50 MPa

3.2. Designed solutions of pavement structures

Design activities of the rehabilitation included milling of the asphalt layers to a specific depth (between 2 and 17 cm), possibly laying the profiling layer (AC 8 with a thickness of 3 cm), laying the steel mesh track (with a tensile strength of 40/50 kN/m) and fitting it to the lower layer with Slurry Seal mixture (with a thickness of 1 cm), next applying the new asphalt layers of total thickness 11 ÷ 18 cm. Details of the designed structures on each road section are given in Table 2.

Table 2. Designed pavement structures for the analyzed sections of roads.

Road number	Chainage	Milling depth	Profiling layer	Interlayer	New asphalt layers
94 - roadway right (section 1)	285+488 ÷ 288+320	2 ÷ 5 cm	-	Steel mesh track with 1cm of Slurry Seal	7 ÷ 9 cm AC 16 + 4cm SMA 11
94 - roadway left (section 2)	285+488 ÷ 288+320	3 ÷ 5 cm	-	Steel mesh track with 1cm of Slurry Seal	7cm AC 16 + 4cm SMA 11
94 (Section 3)	305+100 ÷ 307+100	4 cm	-	Steel mesh track with 1cm of Slurry Seal	8 cm AC 16 + 4 cm SMA 11
44 (Section 4)	101+900 ÷ 102+900	5 cm	3 cm AC 8	Steel mesh track with 1cm of Slurry Seal	8 cm AC 16 + 4 cm SMA 11
4 (Section 5)	482+800 ÷ 483+900	17 cm	3 cm AC 8	Steel mesh track with 1cm of Slurry Seal	9 cm AC 16 + 4 cm SMA 11
28 (section 6)	142+070 ÷ 146+530	5 cm	-	Steel mesh track with 1cm of Slurry Seal	8 cm AC 20 + 4 cm SMA 11
44 (Section 7)	58+500 ÷ 61+100	4 cm	3 cm AC 8	Steel mesh track with 1cm of Slurry Seal	2 x 7 cm AC 16 + 4 cm SMA 11

Designed structures were verified by mechanical-empirical method, using the USA Asphalt Institute fatigue criteria [11] at the temperature of 10°C, which is reliable temperature for pavement design in Poland, acc. to [12]. Material parameters for old pavement layers were assumed acc. to Table 1, while for new asphalt layers they were adopted acc. to design documentation. Stress and strain states in the pavement structures were calculated with the computer program BISAR 3.0, then fatigue durability was estimated, results are given in Table 3. Obtained results have satisfied the requirements for the design traffic category, calculated for a period of pavement exploitation equal to 20 years.

Table 3. Calculated results of the strains and the fatigue life of pavement for the analyzed sections of roads.

Road number	Section	Year of reconstruction	Chainage [km]	Horizontal strain in asphalt layers [*10^{-6}]	Vertical strain on subgrade [*10^{-6}]	Fatigue durability of pavement [Millions of 100 kN/axle]	
						calculated	required
94 - roadway right	1A	2007	285+488 ÷ 286+300	52.8	-132	52.8	27.5
	1B		286+300 ÷ 287+450	47.8	-124	78.8	
	1C		287+450 ÷ 288+320	64.3	-127	33.5	
94 - roadway left	2A	2007	285+488 ÷ 286+650	59.4	-122	46.0	
	2B		286+650 ÷ 287+870	74.3	-131	28.1	
	2C		287+870 ÷ 288+320	39.2	-118	95.8	
94	3	2007	305+100 ÷ 307+100	65.5	-149	29.0	17.3
44	4	2012	101+900 ÷ 102+900	98.0	-202	10.9	5.0
4	5	2011	482+800 ÷ 483+900	76.5	-99	24.6	24.1
28	6	2009	142+070 ÷ 146+530	127.0	-128	7.4	2.7
44	7	2012	58+500 ÷ 61+100	73.1	-158	36.6	6.5

3.3. *Evaluation of the pavement condition after rebuilding*

During a few years after rebuilding, condition of pavements evaluated visually were good, no damage was seen. Additionally, in 2013 the tests of FWD deflection basins were carried out on all road sections, what allowed to compare the bearing capacity of pavements before and after rebuilding. All calculations were made at the equivalent temperature +20°C acc. to [12]. Example of the comparison of the corrected central deflections measured before and after the reconstruction for section No. 2 is shown in Fig.1.

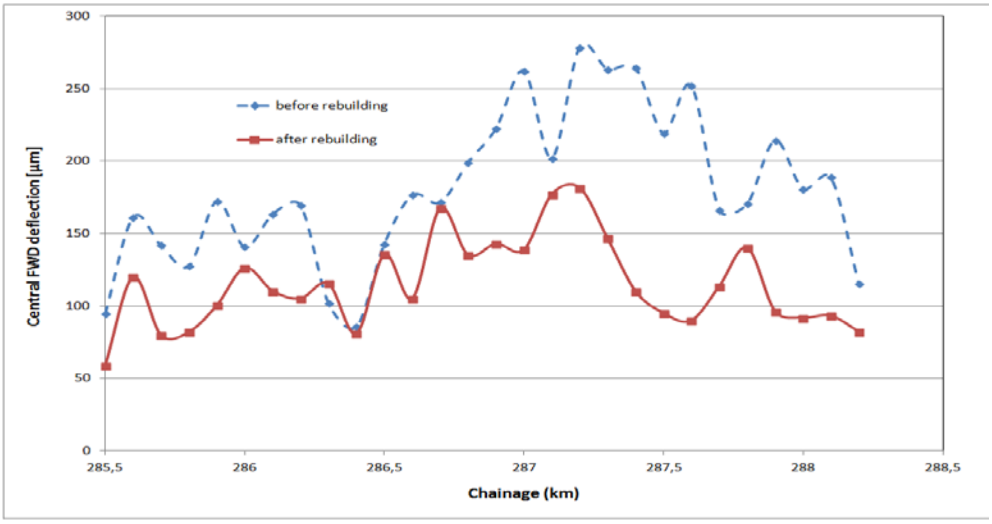

Figure 1. Comparison of the central FWD deflections before and after rebuilding for the road section DK 94, km 285+488-288+320 – roadway left (section 2).

Example of the average FWD deflection basin results, measured before and after rehabilitation are presented in Figure 2 (the highest improvement – section with asphalt overlay) and Figure 3 (the lowest improvement – section with replacement of asphalt layers, without pavement thickening). It was noticed that the differences in deflections measured before and after the rebuilding decrease with the distance from the load axis.

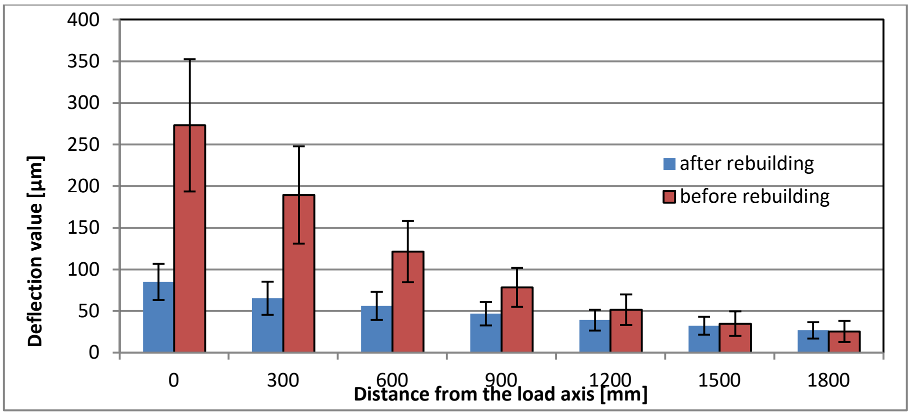

Figure 2. Comparison of the average and standard deviation values of pavement deflection basin before and after rebuilding for the road section DK 94, km 305+100 - 307+100 (section 3).

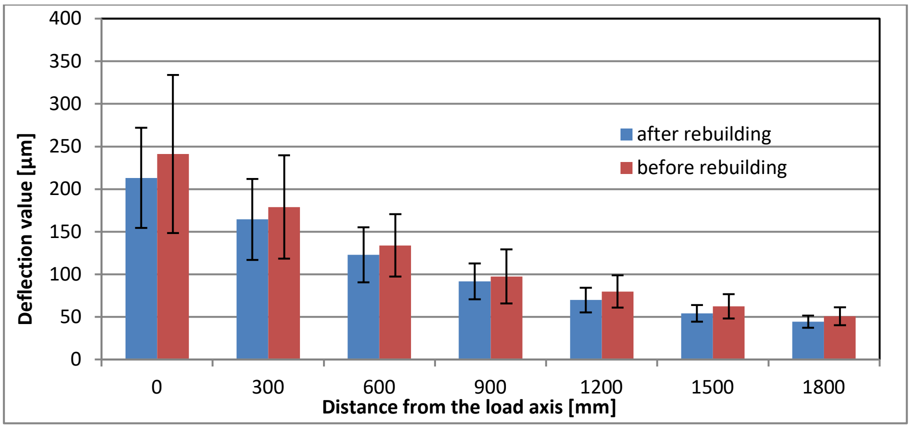

Figure 3. Comparison of the average and standard deviation values of pavement deflection basin before and after rebuilding for the road section DK 4, km 482+800 - 483+900 (section 5).

To evaluate the statistical significance level of the dynamic central deflection (d_0) changes (before and after reconstruction), the tests of multiple comparisons with LSD procedures in the Statgraphics program were carried out. For that test 95% confidence level was used, the results are presented in Table 4.

The results given in Table 4 were used to determine reliable FWD deflections, calculated as the sum of the average value and standard deviation, which are the basis for assessing the bearing capacity of the pavements in Poland, according to the pavement condition evaluation system, i.e. DSN [8]. The results given in Figure 4 show that pavement condition is on the required level, for six sections it is in class A (good condition), only for section 5 (DK4) results are in class B (satisfactory condition).

To evaluate the influence of the steel mesh track on the rebuilt structures bearing capacity, the comparison of the central FWD deflection value with the results for the pavement structure without the steel mesh, which were calculated using analytical model in program BISAR, was done. For this purpose, the deflection values measured using FWD have been converted to static load conditions by coefficient f, acc. to equation (1) from work [13]. The results of deflections measured before and after reconstruction with the values calculated for design solutions are summarized in Table 5.

$$f = -0{,}002 \times r + 1{,}3313 \qquad (1)$$

where: r - distance from load axis [cm]

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Table 4. Analysis of significance of FWD central deflection [µm] differences before and after reconstruction, (T=20°C).

Time of measuring	average	standard deviation	coefficient of variation [%]	difference	+/- limits (95%)
DK 94, km 285+488 – 288+320, roadway right (section 1)					
Before reconstruction	181	73	40.6		
After reconstruction	122	39	31.6	59	38*
DK 94, km 285+488 – 288+320, roadway left (section 2)					
Before reconstruction	180	53	29.4		
After reconstruction	115	31	26.7	65	38*
DK 94, km 305+100 – 307+100 (section 3)					
Before reconstruction	273	80	29.1		
After reconstruction	85	22	25.6	188	31*
DK 44, km 101+900 – 102+900 (section 4)					
Before reconstruction	539	157	29.1		
After reconstruction	230	65	28.1	309	45*
DK 4, km 482+800 – 283+900 (section 5)					
Before reconstruction	241	93	38.6		
After reconstruction	213	59	27.6	28	61
DK 28, km 142+070 – 146+530 (section 6)					
Before reconstruction	570	173	30.4		
After reconstruction	224	49	21.9	346	30*
DK 44, km 58+500 – 61+100 (section 7)					
Before reconstruction	630	150	23.8		
After reconstruction	228	56	24.8	402	39*

*denotes a statistically significant difference

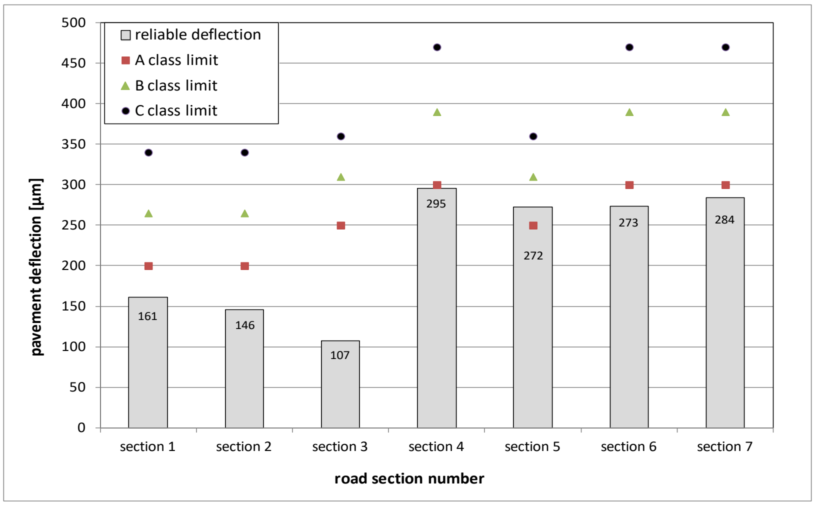

Figure 4. Evaluation of pavement FWD central deflection acc. to DSN [8].

Table 5. Results of the central static deflections in [µm] for the analyzed sections of roads after reconstruction (20°C).

Road number	Chainage [km]	Calculated	Measured	Difference	+/- limits (95%)
94 - roadway right (section 1)	285+488 ÷ 288+320	190	163	37	32*
94 - roadway left (section 2)	285+488 ÷ 288+320	183	153	30	27*
94 (Section 3)	305+100 ÷ 307+100	251	113	138	22*
44 (Section 4)	101+900 ÷ 102+900	397	306	93	54*
4 (Section 5)	482+800 ÷ 483+900	289	284	5	51
28 (section 6)	142+070 ÷ 146+530	484	299	185	Not tested
44 (Section 7)	58+500 ÷ 61+100	390	303	87	Not tested

*denotes a statistically significant difference

3.4. Analyses of the deflection basin parameters

In the next step, analyses of the deflection basins were made using the parameters given in Table 6 acc. to work [14]. The list of calculated average dynamic deflection basin parameters and their standard deviations for chosen individual sections before and after pavement rehabilitation, along with statistical analysis of differences, is shown in Table 7 (calculations at 10°C). In the case of the section 4, 6 and 7 due to the lack of FWD measurements before reconstruction only the results of FWD basin parameters after are given. Figure 5 shows the mean values and standard deviations for the SCI parameter for sections before and after rebuilding.

Table 6. FWD deflection basin parameters.

Deflection parameter	Formula	Parameter's objective
Surface Curvature Index (SCI)	$SCI = d_0 - d_{300}$	Condition of bound layer
Base Damage Index (BDI)	$BDI = d_{300} - d_{600}$	Condition of bound layer
Base Curvature Index (BCI)	$BCI = d_{600} - d_{900}$	Condition of subbase layer
Area Under Pavement Profile (AUPP)	$AUPP = \frac{5d_0 - 2d_{300} - 2d_{600} - d_{900}}{2}$	Condition of the pavement upper layers
Area (AREA)	$AREA = \frac{150(d_0 + 2d_{300} + 2d_{600} + d_{900})}{d_0}$	Shape of the deflection basin close to the load by the normalized area on the top of the deflection basin

Note: d_i – deflection at *i* mm from the center of loading plate in μm

Table 7. Average (standard deviation) deflection basin parameters for sections before and after pavement rehabilitation.

Time of measuring	d_0 [μm]	SCI [μm]	BDI [μm]	BCI [μm]	AUPP [μm]	AREA [mm]
DK 94, km 285+488 – 288+320, roadway right (section 1)						
Before rehabilitation	145 (59)	39.3 (26.1)	31.6 (16.7)	21.8 (8.0)	156 (92)	586 (54)
After rehabilitation	98 (31)	28.3 (10.7)	19.1 (8.7)	14.6 (5.2)	108 (41)	569 (51)
difference	47	10.6	12.5	7.2	48	17
+/- limits (95%)	43*	7.4*	8.3*	4.8*	37*	28
DK 94, km 285+488 – 288+320, roadway left (section 2)						
Before rehabilitation	144 (42)	39.7 (15.9)	31.1 (12.2)	21.9 (7.0)	157 (58)	574 (58)
After rehabilitation	92 (25)	25.0 (7.6)	17.0 (6.2)	12.7 (4.1)	94 (29)	590 (59)
difference	52	14.7	14.1	9.2	63	16
+/- limits (95%)	43*	7.4*	8.3*	4.8*	37*	28
DK 94, km 305+100 – 307+100 (section 3)						
Before rehabilitation	219 (64)	64.0 (28.3)	57 (23.1)	34.5 (16.4)	263(102)	544 (60)
After rehabilitation	68 (17)	15.8 (4.4)	7.4 (3.8)	7.4 (3.4)	54 (16)	656 (60)
difference	151	48.2	50	27.1	209	112
+/- limits (95%)	36*	5.0*	6*	3.9*	30*	23*
DK 44, km 101+900 – 102+900 (section 4)						
After rehabilitation	184 (52)	47.0 (20.2)	39.2 (17.9)	26.2 (8.9)	189 (81)	601 (45)
DK 4, km 482+800 – 283+900 (section 5)						
Before rehabilitation	193 (74)	49.7 (32.9)	36.2 (24.8)	29.0 (23.6)	193 (126)	615 (71)
After rehabilitation	170 (47)	38.9 (10.9)	33.3 (13.1)	24.9 (9.5)	160 (49)	619 (30)
difference	23	10.8	2.9	4.1	33	4
+/- limits (95%)	48	11.9	7.4	5.3	41	31
+/- limits (85%)	36	8.7*	6.8	3.9*	30*	26
DK 28, km 142+070 – 146+530						
After rehabilitation	179 (39)	36.4 (14.7)	35.0 (12.7)	25.7 (8.0)	156 (57)	644 (48)
DK 44, km 58+500 – 61+100 (section 7)						
After rehabilitation	182 (45)	43.6 (20.5)	38.7 (15.5)	27.1 (6.7)	180 (76)	612 (51)

*denotes a statistically significant difference

Area Under the Pavement Profile (AUPP) is used as a parameter for the determination of the tensile strain at the bottom of asphalt layer (ε_{ac}), which allows to calculate the pavement fatigue life. Since the AUPP is a geometric property of the deflection basin, the use of the AUPP for the prediction of ε_{ac} is not affected by the type of subgrade and pavement. For aggregate base pavements, the relationship between ε_{ac} and AUPP developed by Thompson [9] is as follows (AUPP in mils):

$$\log(\varepsilon_{ac}) = 0.821 \times \log(AUPP) + 1.210 \quad (2)$$

Another method to predict the ε_{ac} is presented by Kim and Park [10], where two approaches were used. The first approach uses a statistical regression method to relate ε_{ac} with BDI (in mils) and asphalt layers thickness (H_{ac} in inches), which is expressed in equation (3). Another method to predict ε_{ac} values is plotted in equation (4) with utilization of AUPP.

$$\log(\varepsilon_{ac}) = 1.082 \times \log(BDI) + 0.259 \times \log(H_{ac}) + 1.409 \quad (3)$$

$$\log(\varepsilon_{ac}) = 1.034 \times \log(AUPP) + 0.932 \quad (4)$$

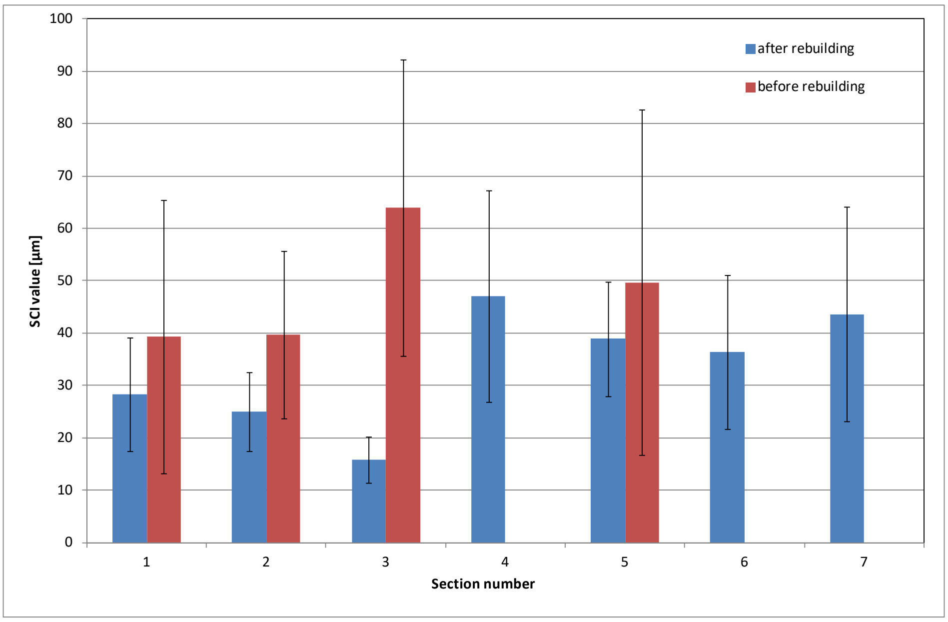

Figure 5. The mean values and standard deviations for the SCI parameter for sections before and after rebuilding.

The results of the determination of tensile strains at the bottom of the asphalt layers ε_{ac}, calculated according to the formulas (2÷4) and according to the design as well as the fatigue life determined on their basis for specific 11 sections of road (at temperature 10°C) are presented in Table 8.

Table 8. Calculated results of ε_{ac} and the fatigue durability of pavement for the analyzed sections of roads

Road number (section)	ε_{ac} [$*10^{-6}$], calculated acc. to				Fatigue life of pavement [Millions of 100 kN/axle], acc. to			
	equation *(2)*	equation *(3)*	equation *(4)*	Design calculations	equation *(2)*	equation *(3)*	equation *(4)*	Design calculations
94 - roadway right (section 1)	61	46	47	53	38.0*	96.1	89.5	52.8
	46	32	31	48	101.5	335.3	372.2	78.8
	54	39	40	64	67.5	197.2	181.4	33.5
94 - roadway left (section 2)	46	32	29	59	108.2	357.1	493.7	46.0
	52	38	39	74	91.2	256.0	235.0	28.1
	36	24	22	39	143.8	546.3	727.5	95.8
94 - (section 3)	30	19	13	65	379.2	1704.8	5943.8	29.0
44 (Section 4)	83	68	79	98	18.8	36.2	22.1	10.9
4 (Section 5)	73	57	66	76	28.7	64.8	40.0	24.6
28 (section 6)	71	56	69	127	31.5	68.7	34.6	7.4
44 (Section 7)	80	65	77	73	27.2*	53.8	30.8*	36.6

* sections with lower calculated fatigue life according to correlation equations than design value

4. Results discussion

For all analyzed road sections, where overlays were made, central deflection values after reinforcement are suitably lower than before that treatment, the highest differences were observed for the section of previously the lowest bearing capacity and the thickest of the asphalt overlay (DK44, km 58+500 – 61+100), where steel mesh track is situated in the tension zone of the asphalt layers. In the case of a section where only the replacement of asphalt layers was carried out (DK4), without their thickening, there was no statistically significant reduction of central deflections, but the homogeneity of the results measured after rehabilitation was improved, which was also confirmed on other rebuilt sections as diminishing of the values of deflection variability. This improvement of the uniformity of deflections, even with a similar level of average values, results in a favorable reduction in the value of reliable deflections, thus obtaining a higher bearing capacity rating, acc. to diagnostic system [8].

With the exception of section 5, significantly lower values of deflections calculated in relation to the measured ones were observed, which may indicate the influence of the applied steel mesh track on the behavior of the pavement structure bearing capacity.

The results contained in Table 7 indicate a statistically significant improvement of all parameters describing the condition and the bearing capacity of the upper layers of pavement (SCI, BDI and AUPP) for sections after reinforcement with a steel mesh track, except for the section No. 5, where only the exchange of asphalt layers has been done, without thickening the pavement structure. Additionally, in the case of all sections with a steel mesh track, a statistically significant increase in the BCI parameter was found, which indicates improved condition of subbase layer. This improvement was much more visible for section 3, where an asphalt overlay was applied as compared to section 5, where only the asphalt layers were replaced. In the case of the AREA parameter, which takes into account a change in the stiffness of individual pavement layers, except the section No. 3, no significant differences after the reconstruction were found. After reconstruction, all parameters of the deflection basin with the exception of AREA have much smaller dispersion, which is a desirable effect.

The results of the tensile strain at the bottom of the asphalt layers, obtained on the basis of the correlation from the measured parameters of the deflection basin are in most cases much smaller than those specified in the design documentation. This means, that pavement durability estimated on the basis of FWD measurements is greater than originally calculated for the planned pavement solutions. This effect of the expected extension of durability of the pavement structure can be attributed to the use of steel mesh track under the new asphalt layers, which improves the parameters of the deflection basin, describing the state of the upper asphalt layers (SCI, BDI and AUPP). At the same time, it was found that equation *(2)* gives the largest expected tensile strains of asphalt layers and thus their lowest durability, while the durability determined by equation *(3)* is by far the largest.

5. Conclusions

Presented in this paper tests of the road sections and analyses of the results allowed to draw the following conclusions:

- Evaluation of pavements of all analysed road sections reconstructed with the steel mesh track after several years of exploitation shows good condition, without any damages and imperfections. Bearing capacity of the tested sections determined acc. to the diagnostic system, classifies all road tested sections in class A, except section No. 5, where class B was established.
- Average central FWD deflections of pavements after reconstruction with steel mesh track and asphalt overlay decreased significantly. Additionally an improvement of the uniformity of deflection basins was observed, which results in a more homogenous bearing capacity and then gives better condition of pavement maintenance.
- The positive effect of the use of steel mesh track has been demonstrated by comparing the deflections measured and calculated for the pavement model without a mesh, for most cases the reduction of central deflection turned out to be statistically significant.

- In 10 out of 11 analyzed road sections, fatigue life of rebuilt pavements with the application of steel mesh track, determined on the basis of measured deflection basins, turned out to be higher than those calculated at the design stage.
- In general, the best effectiveness of strengthening the pavement was observed on the sections with the initially lowest bearing capacity, where the mesh was located in the tensile zone of asphalt layers.

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