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RULES FOR USING THE POINT RATING SCALES IN INSPECTIONS OF ROAD BRIDGES

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The article discusses "Rules for using the point rating scales for assessing the technical condition and usability of road engineering objects – second edition", which were introduced by the General Directorate for National Roads and Motorways (GDDKiA) Regulation No. 1/2019. The main objective of "Rules..." was to standardize the method of point rating assessment of technical condition and usability, and in the second edition, to take into account the latest construction and material solutions. Because the results of inspections are analyzed and compared not only at the regional but also at the national level, it is very important for all inspectors in the country to evaluate the technical condition and usability in an analogous manner. While developing the 2nd edition, the authors maintained the assumptions of continuity of inspection system, including adaptation to the inspection manuals, algorithms, and software supporting the management of bridges.

Keywords: road bridges, inspections, technical condition assessment, assessment of usability

1. INTRODUCTION

Public road managers are required to maintain road engineering objects in a good technical and aesthetic condition, and to prevent the excessive deterioration of usability and technical efficiency. It is impossible to fulfill the above requirements without periodic inspections. The administrations of most

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countries have their own guidelines and rules for conducting inspections, which examples are given, among others, in [4, 9, 11, 18]. General recommendations, such as those developed within European grants, are also available [3]. According to the Polish Construction Law [12], each year, it is necessary to check the technical condition of structural elements and equipment, systems installed in an object, environmental protection equipment, and ventilation systems if they had been installed. Once every five years, an inspection should be carried out, which should include checking the technical condition, usability, and aesthetics. The requirements of the Construction Law have been elaborated and extended in the Ordinance [13], where, among others, the scale and criteria of assessment were provided to be used during inspections. The results of inspections are compared and analyzed at the regional, GDDKiA-branch, and national level. They are also used in algorithms supporting decision-making processes [5, 6, 7]. Such analyses and comparisons are reliable and useful only if all inspectors in the country will assess the technical condition and usability in the same way, i.e. according to uniform rules and criteria. To facilitate this, the Regulation "Rules for using the point rating scales for assessing the technical condition and usability of road engineering objects" was developed [15]. This article discusses the new, second edition of the "Rules...", which was introduced for use on national roads by the Regulation of GDDKiA No. 1/2019 [16, 17].

2. INSPECTION SYSTEM AND POINT RATING SCALES

Inspections of objects located along national roads and motorways in Poland are carried out in accordance with the Regulation [14], and their results are used in the daily activities of managers, including planning the ongoing maintenance, renovation, and reconstruction. The control system is adapted to the requirements of the Construction Law [12] and the Ordinance [13]. The system scheme is shown in Fig. 1.

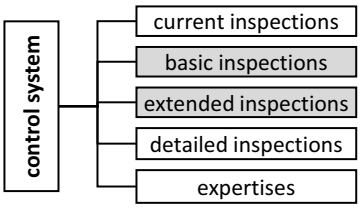


Fig. 1. Block diagram of the control system of engineering road objects on national roads (inspections in which point rating scales are applied were marked in grey)

The simplest type of control are current inspections, which are carried out by road-masters at intervals depending on the road class. The purpose of these inspections is to identify damages that directly

threaten the safety of traffic, reduce the comfort of use, or indicate the need to conduct more advanced emergency inspections. Basic inspections are carried out by bridge inspectors at least once a year and their main purpose is to check the technical condition of object, environment, systems and devices used for environmental protection as well as register changes that have occurred during use. Extended inspections are carried out at least every five years and they are more advanced that basic inspections in order to check the usability and aesthetics of object as well as the condition of third-party facilities. In the case of basic and extended inspections, point rating scales are used. The aim of detailed inspections is primarily to document the technical and functional condition of object and to advocate improvements of functional characteristics. These inspections are performed in the case of large objects (bridges longer than 80 m or with span of more than 40 m) once every five years. Other objects are inspected in detail if a necessity arises during basic or extended inspections. Expertises include assessing the technical condition of entire object or its parts, and are issued on the basis of specialist tests, measurements, and calculations. The Ordinance [13] provides the point rating scale for assessing the damage of technical condition, which should be used during the basic (annual) and extended (five-year) inspections – Table 1. A brief description of the technical condition, corresponding to particular ratings, is also provided.

Table 1. Scale for assessing the technical condition

Rating	Condition	Description
5	suitable	no damage or dirt found during the inspection
4	satisfactory	the first signs of dirt or damage influencing the aesthetic appearance
3	worrying	damage, which left unrepaired shortens the safe operation period
2	insufficient	damage possible to be repaired but reducing the usability
1	alarming	irreversible damage disqualifying usefulness
0	emergency	destroyed or inexistent

The Regulation [14] provides the point rating scale for assessing the usability – Table 2. As in the case of technical condition, for each rating a criterion was assigned.

Table 2. Scale and criteria for assessing the usability

Rating	Usability	Assessment criteria
5	sufficient	the parameter fulfils or exceeds the requirements of users
2	limited	the parameter does not fulfil the requirements of users or fulfils them partially, no instant repairs are necessary
0	insufficient	the parameter does not fulfil the requirements of users, instant repairs or renovation is necessary

The assessment of technical condition and usability made on the basis of the above-mentioned, concise descriptions and criteria often gave the inspectors difficulties. Despite the knowledge of literature, e.g. [1, 2, 8, 10] and courses, inspectors sometimes attributed different ratings to the same damage. To eliminate such cases and limit the number of errors, the discussed "Rules..." were elaborated.

3. STUDY OUTLINE

The current edition of "Rules..." consists of two parts: part I concerns bridge structures [16], part II concerns tunnels, culverts, and retaining structures [17]. In both parts, chapters devoted to particular types of road engineering objects have been divided into sub-chapters. The titles of sub-chapters are at the same time the names of elements being evaluated, listed in the same order as in the inspection protocol samples given in the Regulation [14]. The rules for assessing the technical condition are discussed in four blocks. The first block is an *introduction* (so-called preamble) located directly under the title of sub-chapter. Primarily, this block specifies which parts of an object are subjected to the assessment according to the given sub-chapter, and indicates the method of dealing with non-typical cases. The second block is a *table* containing the description of damages that may occur in the assessed object. The ratings and example codes were attributed to each type of damage. The rating value depended on the damage range, its influence on aesthetics, durability, and safety of element/object. An example used for assessing bearings is shown in Table 3. The third block included *detailed remarks*, which in some cases were preceded by a comment or general remarks. Detailed remarks were given in the order corresponding to the damages mentioned in the second block, i.e. in the *table*. Comments and remarks contain explanations and clarification of the assessment rules as well as the method of dealing with non-typical cases. The fourth block included *damage examples*. Each example is accompanied by a photograph, brief damage description, damage codes, and point rating. If in each element there are various types of damage (e.g. contamination, damage of corrosion protection, cracking, corrosion, deformations etc.), the final assessment is determined by the damage with the lowest rating. The examples of structures having been in use for several decades and objects built several years ago are shown in Fig. 2.

The new edition of "Rules..." includes structures that have been built in the country in recent years, such as extradosed bridges, objects made of composite materials, new-generation prefabricated prestressed beams, and monolithic concrete with external prestressing cables. The rules for assessing the technical condition of a new type of structural elements were provided, including cable barriers, decorative/masking covers, plastic bridge cornices.

Table 3. Example of rules for using point rating scales for assessing the technical condition of bearings

No.	Damage type			Damage range [%]					Example damage codes*
				0	≤ 5	10	20	≥30	
1	Contamination			5	4		3		NB, NS, NG
2	Faulty bearing position:	a	affecting durability	5	3				PB, PS, PG, DG
		b	limiting their performance	5	2				
		c	threatening the structure	5	1				
3	Movement limitation			5	3				BB, BS, BG, BK
4	Movement blocked			5	2				
5	Bearing corrosion			5	4	3	2	1	KB, KS, KZ
6	Damage of elastomeric bearings: aging, cracking, deformations, uneven strains and other damages of an elastomer			5	4	3	2	1	KG, DG, RG
7	Bearing cracking			5	1				RB, RS, RK
8	Concrete bearing cracking	a	due to shrinkage cracking	5	3				RB
		b	due to overload	5	2				
9	Damage of spacer bearing:	a	bitumen leakage	5	4				NB, KA, UA
		b	losses or cracking directly above or under the spacer	5	3				UB, RB
10	Grout cracked or not covering the entire bearing surface (top or bottom plate)			5	3	2		1	UB, RB
11	Damages of position indicators, nameplates, spirit levels, protective aprons			5	4		3		US, KS, NS, DS, UM, KM, NM, DM, UG, RG
12	Damages or lack of protective (anti-corrosion) surfaces on steel bearings			5	4	3			AS
13	PTFE pad sliding or extrusion, elastomer extrusion			5	1				DM, PM, UM, ZM, DG, UG, ZG

*) damage codes according to the manual given in [14]

The method of assessing the basic elements of a load-carrying structure of spans was detailed. First of all, these elements of spans were included, which should be considered in the assessment of a deck and girders. In this classification, prepared for the purposes of "Rules...", the majority of modern construction solutions were taken into account, namely: beam-, slab-, slab-beam-, box-, tied-arch-, deck-arch-, through-arch-, beam- reinforced with a thin arch, cable-stayed- with beams/longitudinal girders, cable-stayed- without beams/longitudinal girders, suspended-, extradosed-, truss-, vaulted-, soil-shell-, and stressed-ribbon-bridges. A new qualitative way of assessing cracking in a deck and concrete girders was introduced, both in reinforced concrete and prestressed concrete structures.

a)

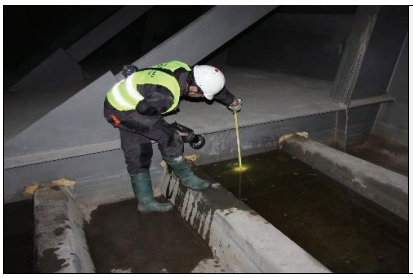
Damage description: damage of the anti-corrosion coating and extensive corrosion of corrugated steel being part of the deck; minor surface corrosion of traverse beams

Damage code: AS, KS, ZS

Rating: 2

Remarks: corrosion caused deck defects

b)



Damage description: water ponding inside box-structured span; damaged drainage system; blocked holes draining the water from the box
Damage code: BS
Rating: 1
Remarks: phenomenon particularly dangerous in winter; it is urgent to eliminate the cause of ponding and, possibly, clear the drain holes

c)

Damage description: cracks in the cross-brace of a deck truss bridge; corrosion of girder elements; pre-failure condition
Damage code: RS, KS, AS
Rating: 1
Remarks: it is necessary to carry out an emergency expert evaluation

d)

Damage description: cracking of the hanger in an arch bridge; in several longest hangers, in points where they are connected to the gusset plates, cracking covers about 50% of the hangers' cross-section; girder in pre-failure condition
Damage code: RS, PS
Rating: 1
Remarks: it is necessary to introduce limitations in public traffic and to conduct an emergency expert evaluation

Fig. 2. Examples of assessment of technical condition with damage description, damage code, rating, and remarks: (a) deck corrosion, (b) faulty drainage and water ponding in a box structure, (c) cracks in the cross-brace of a truss bridge, (d) cracking of the hanger in an arch bridge

In the prestressed elements, the assessment of cracking condition depends on the condition of element's prestressing (full, limited, partial prestressing) and the standards used for its design (withdrawn standards or Eurocodes). The following cracking types were included: shrinkage cracks, cracks along the corrosive reinforcement, overload cracks, and cracks in technological contact areas.

The principle of assessing a deck and girders with their components including external tendons (hangers, ropes, prestressing cables) was clarified. It was recommended to assess the condition of tendons along with the anchorages and to assume the final rating of deck/girders to be the lowest rating value of bridge/girders and tendons/anchorages. In the new edition of "Rules...", there are also new guidelines for assessing the technical condition of wooden, composite, and soil-shell girders.

The method of assessing pot, spherical, and elastomeric bearings, i.e. the most commonly used bearings, was updated. The rules for assessing grouts, displacement indicators, protective aprons etc. were specified. The rules for assessing expansion devices were detailed, including the rules for assessing the damage of noise suppressing pads, cantilever finger joints, and modular devices with scissors mechanisms. The guidelines for assessing an expansion joint, located defectively and inadequately to temperature, were provided. The rules for assessing abutments were detailed in the area of rating rigid-frame/integrated or vaulted objects in which the support structure is not isolated. The rules for assessing split abutments, massive abutments with wing walls equipped with expansion joints based on a common foundation with a head wall, and abutments with wing walls made of reinforced soil are given. The method of conducting cases of soil-shell objects with a closed cross-section was indicated. It was found that in the assessment of bridge piers, pylons in suspended and cable-stayed bridges and so-called low pylons in extradosed structures should be taken into account. The rules for assessing piers in multi-span vaulted objects and multi-span soil-shell structures, both with an open and closed cross-section, were given. Both in the case of abutments as well as piers, the damage assessment depended on their impact on durability, load-carrying capacity, stability, and safety. In the assessment of a river bed and space under a bridge, the rules for rating damages that may affect the durability or stability of banks, slopes and embankments are specified. The rules for damage assessment of retaining structures at abutments, including elevation panels in reinforced soil structures, are given. With respect to environmental protection equipment, the second edition of "Rules..." provides new guidelines for assessing the damage of backfill and vegetation in the upper wildlife crossings. Many examples of damages of noise barriers were presented. The rules for assessing external tendons and their anchorages included extradosed, tensegrity, and ribbon structures. The examples were given including assessing the damage of deviators and tendons in the event of individual strands or cables breaking. Among the types of damage, excessive vibrations of tendons were distinguished.

Detailed remarks concerning third-party facilities were clarified – e.g. the rules for assessing elevators take into account the impact of damage on durability and safety of their use. In the assessment of decks, inspection trolleys and ladders, detailed remarks about cases of theft, devastation or complete destruction of elements facilitating access to the object for maintenance purposes were added. The rules and scope of assessing the technical condition of electrical and lightning protection systems performed by the bridge inspector were discussed.

The guidelines for assessing equipment components attached to structures were provided in terms of following elements: marks, water gauges, service ducts, object protection against wildlife and third-party access. In order to standardize the method of assessing the usability, the most frequently occurring anomalies and/or damages limiting this usability were presented in the table – a part of the table used to assess balustrades, barriers, and covers attached to bridge objects is shown in Table 4.

Table. 4. Examples of assessing usability of balustrades, barriers, and covers

Element	Description	Rating
Balustrades, barriers, covers	no significant anomalies and damages	5
	strong corrosion (with perforation) affecting the safety	2
	deformation or displacement	2
	loosening of individual fasteners	2
	element too low above the pavement	2
	destruction of reflecting elements fastened to barriers (30% or more)	2
	no safety barriers on the site built when there was no obligation to use barriers	2
	no burying and anchorages, below the ground level, of the initial and end parts of a safety barrier	2
	destruction (breakage) of basic elements	0
	losses of individual filling elements that pose a threat of falling out	0
	no electric-shock protection	0
	damage of fastening elements that pose a direct threat to public traffic safety	0

The new edition of "Rules..." also includes numerous examples. Each example contains a photo, description, and usability rating – Fig. 3.

Description: Too small width of the pavement on the right side of the bridge, no curbs on the left side, intense pedestrian and cyclist traffic (there is a primary school nearby) and heavy vehicle traffic (AADT above 23,000) – safety of bridge users is limited
Usability rating:
- public traffic safety: 0
- width of the structure clearance: 2

Fig. 3. Example of bridge usability assessment

In the rules for bridge object assessment, most changes were introduced in terms of the parameter "public traffic safety". The assessment of a road pavement was dependent on the results of tests and measurements of technical and operational parameters being a part of the pavement condition diagnosis. For balustrades, barriers, and covers, additional cases of limited usability assessment were given. Ratings of such elements as: stairs, ramps, elevators, electrical and lightning protection systems, clearance/space under an object, objects on mining areas were added. In the case of the parameter "structure clearance under an object", the rules for usability assessment were extended by wildlife migration routes.

4. FINAL ASSESSMENT OF THE TECHNICAL CONDITION AND USABILITY

Point rating scales used for assessing the technical condition of individual elements of bridge structure are placed in the form of periodical inspection of technical condition, and are the basis for determining the assessment of the “technical condition of whole object” – factor F_t. This factor is determined on the basis of the arithmetic mean (A_m), assessment of deck structure (A_d), assessment of main girders’ structure (A_g), and assessment of supports (A_s).

The arithmetic mean of assessment of all elements rated during the inspection is calculated by:

$$A_m = \frac{\sum_{i=1}^{n} A_i}{n} \tag{4.1}$$

where: A_i – assessment of individual element, n – number of assessed object elements.

The „assessment of the whole object” equals:

$$F_t = \min \{A_m, A_d, A_g, A_s\} \tag{4.2}$$

Ratings are used in numerical algorithm for the determination of the bridges' repair priority, which is used in GDDKiA and covers about 8 thousand bridge structures. The algorithm is based on neural networks and enables to create a ranking list, where the objects with the highest priority will occupy the first positions. A set of factors that affect this priority has been created, the three main ones were the technical condition factor (F_t), safety factor (F_s), and importance factor (F_i). The factors depend primarily on the assessment of technical condition and usability. The general way of proceeding is shown in the block diagram in Fig. 4, details of the algorithm are described in [6, 7].

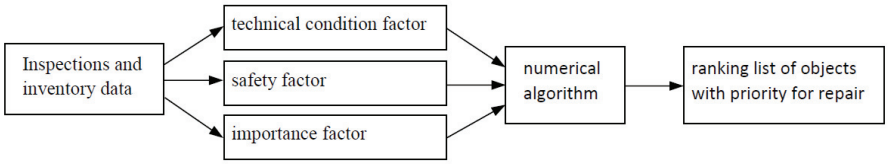


Fig. 4. The general scheme for determining the ranking list [7]

5. CONCLUSIONS

The article discusses the main assumptions of "Rules for using the point rating scales for assessing the technical condition and usability of road engineering objects" as well as changes and additions that were introduced to the new edition, which was published in 2019 [16, 17]. The authors of study took into account the latest construction and material solutions and presented many examples of damage and anomalies – altogether, the study contains about 400 examples of damages of bridge objects and about 270 examples of damages of tunnels, culverts, and retaining structures. This is the only so comprehensively conducted study that makes it easier for inspectors to assess the structure condition, and above all to unify the method of assessing the same damage.

Obviously, all the possible cases were not discussed and some of them, even only due to the detailed level of inspections, were treated in a general way. The discussed study was introduced by the Regulation of the General Director for National Roads and Motorways and is to serve primarily bridge inspectors. Obviously, it is not enough to know the "Rules..." in order to properly assess road engineering objects. It is necessary to be able to analyze the structure performance and to assess the causes of damage and their consequences, with this knowledge having been acquired, among others, during professional studies and specialized trainings. A bridge inspector knowing "Rules..." and assessing the technical condition and usability should follow mainly his own knowledge and experience. He or she should ask for expertise, limit the load capacity, or close the object for traffic, even if such necessity does not result from the "Rules..." and is justified due to the condition of an object.

REFERENCES

1. J. Bień, "Uszkodzenia i diagnostyka obiektów mostowych", WKŁ, 2011.
2. J. Bień, T. Kamiński, M. Kużawa, "Monitoring in management of roadway bridges", Maintenance, Safety, Risk, Management and Life-Cycle Performance of Bridges - Proceedings of the 9th International Conference on Bridge Maintenance, Safety and Management, IABMAS, 2018.
3. Bridge Management in Europe – BRIME, Research Project, 4th Framework Programme, Final report 2011, www.trl.co.uk.
4. M.P. Enright, D.M. Frangopol, "Survey and Evaluation of Damaged Concrete Bridges, Journal of Bridge Engineering, Vol. 5, No. 1, pp 31-38, 2000.
5. L. Janas, B. Miller, "Zastosowanie sieci neuronowych do wspomagania zarządzania obiektami mostowymi. Zeszyty Naukowe Politechniki Rzeszowskiej. Budownictwo i Inżynieria Środowiska. Nr 276, z. 58 (3/11/III), s. 181-190, 2011.
6. L. Janas, A. Kaszyński, B. Miller, "Algorytmy wspomagające proces zarządzania drogowymi obiektami inżynierskimi, Drogownictwo, No. 9, pp 285-289, 2017.
7. L. Janas, B. Miller, A. Kaszyński, "Computational algorithms supporting the bridge management system, Baltic Journal of Road and Bridge Engineering, vol. 13, No. 4, pp 357-373, 2018.
8. A. Jarominiak, "Przeglądy obiektów mostowych, WKŁ, 1991.
9. J. Lauridsen, B. Lassen, "The Danish Bridge Management system DANBRO, Management of Highway Structures, Thomas Telford, London, pp 61-70, 1999.
10. M. Salamak, M. Januszka, "Brim bridge inspections in the context of industry 4.0 trends", Maintenance, Safety, Risk, Management and Life-Cycle Performance of Bridges - Proceedings of the 9th International Conference on Bridge Maintenance, Safety and Management, IABMAS, 2018.
11. M.K. Soderqvist, M. Veijola, "The Finnish Bridge Management System", Structural Engineering International, Vol. 8, No. 4, pp 315-319, 1998.
12. The Ordinance dated July 7, 1994 Construction Law (Journal of Laws of 2018, item 1202), 2018 [in Polish].
13. The Ordinance of the Minister of Infrastructure dated February 16, 2005 on public road, bridge, tunnel, culvert and ferry registration, and on road, bridge, and tunnel number records (Journal of Laws of 2005, No. 67, item 582), 2005 [in Polish].
14. The Regulation of GDDKiA No. 5/2011: Inspection manual for road engineering structures, GDDKiA, (ed. L. Janas, A. Jarominiak, E. Michalak), Warsaw 2011 [in Polish].
15. The Regulation of GDDKiA No. 64/2008: Rules for using the point rating scales for assessing the technical condition and usability of road engineering objects, edition 1, GDDKiA, (ed. L. Janas, E. Michalak), Warsaw 2008 [in Polish].
16. The Regulation of GDDKiA No. 1/2019, Appendix 1: Rules for using the point rating scales for assessing the technical condition and usability of road engineering objects, edition 2, part I. Bridges, GDDKiA, (ed. L. Janas, E. Michalak, A. Kaszyński), Warsaw 2018 [in Polish]. https://www.gddkia.gov.pl/pl/a/6608/materialy-pomocnicze-do-pobrania.
17. The Regulation of GDDKiA No. 1/2019, Appendix 2: Rules for using the point rating scales for assessing the technical condition and usability of road engineering objects, edition 2, part II. Tunnels, culverts, and retaining structures, GDDKiA, (ed. Janas L., Michalak E., Kaszyński A.), Warsaw 2018 [in Polish]. https://www.gddkia.gov.pl/pl/a/6608/materialy-pomocnicze-do-pobrania.
18. P.D. Thompson, E.P. Small, M. Johnson, A.R. Marshall, "The PONTIS Bridge Management System", Structural Engineering International, Vol. 8, No. 4, pp 303-308, 1998.

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ZASADY STOSOWANIA PUNKTOWEJ SKALI OCEN W CZASIE PRZEGLĄDÓW MOSTÓW DROGOWYCH

Słowa kluczowe: mosty drogowe, przeglądy, ocena stanu technicznego, ocena przydatności do użytkowania

STRESZCZENIE:

W artykule omówiono "Zasady stosowania skali ocen punktowych stanu technicznego i przydatności do użytkowania drogowych obiektów inżynierskich – wydanie 2", które zostały wprowadzone do stosowania Zarządzeniem nr 1/2019 przez Generalną Dyrekcję Dróg Krajowych i Autostrad. Głównym celem "Zasad …" było ujednolicenie metody punktowej oceny stanu technicznego i przydatności do użytkowania oraz uwzględnienie najnowszych rozwiązań konstrukcyjnych i materiałowych.

Zarządcy dróg publicznych są zobowiązani do utrzymywania drogowych obiektów inżynierskich w należytym stanie technicznym i estetycznym, oraz niedopuszczenia do nadmiernego pogorszenia właściwości użytkowych i sprawności technicznej. Spełnienie ww. wymagań nie jest możliwe bez okresowych kontroli. Zgodnie z Prawem budowlanym każdego roku należy sprawdzić stan techniczny elementów konstrukcji i wyposażenia, instalacji zamontowanych w obiekcie, instalacji i urządzeń służących ochronie środowiska oraz instalacji wentylacyjnych, jeśli takie zostały zamontowane. Raz na pięć lat należy przeprowadzić kontrolę, która powinna polegać na sprawdzeniu stanu technicznego, przydatności do użytkowania i estetyki. Ponieważ wyniki przeglądów są analizowane i porównywane nie tylko na poziomie oddziałów regionalnych ale również na poziomie krajowym bardzo ważne jest aby wszyscy inspektorzy w kraju oceniali stan techniczny i przydatność do użytkowania w analogiczny sposób.

Najprostszym rodzajem kontroli są przeglądy bieżące, które są wykonywane przez drogomistrzów w odstępach zależnych od klasy drogi. Celem tych przeglądów jest stwierdzenie uszkodzeń, które bezpośrednio zagrażają bezpieczeństwu ruchu, uszkodzeń które zmniejszają komfort użytkowania lub wskazują na konieczność przeprowadzenia w trybie awaryjnym przeglądów bardziej zaawansowanych. Przeglądy podstawowe wykonują inspektorzy mostowi co najmniej raz w roku a ich głównym celem jest sprawdzenie stanu technicznego obiektu, otoczenia, instalacji i urządzeń służących ochronie środowiska oraz rejestracja zmian powstałych w czasie użytkowania. Przeglądy rozszerzone są wykonywane co najmniej raz na pięć lat a ich zakres jest zwiększony w stosunku do przeglądów podstawowych o sprawdzenie przydatności do użytkowania i estetyki obiektu oraz stanu urządzeń obcych. W przeglądach podstawowych i rozszerzonych stosuje się skalę punktową ocen.

W Rozporządzeniu Ministra Infrastruktury podano skalę ocen uszkodzeń stanu technicznego, którą należy stosować w czasie przeglądów podstawowych (kontroli rocznych) i rozszerzonych (kontroli pięcioletnich). Podano też krótki opis charakteryzujący stan techniczny, odpowiadający poszczególnym ocenom. W Zarządzeniu Nr 5/2011 podano skalę ocen przydatności do użytkowania. Podobnie jak w przypadku stanu technicznego, każdej ocenie przypisano krótkie kryterium. Ocena stanu technicznego i przydatności do użytkowania dokonywana na podstawie ww., zwięzłych opisów i kryteriów często sprawiała inspektorom trudności. Niekiedy tym samym uszkodzeniom przypisywano różne oceny. Aby wyeliminować takie przypadki i ograniczyć liczbę błędów opracowano omawiane „Zasady…". Aktualne wydanie składa się z dwóch części: część I dotyczy obiektów mostowych, część II dotyczy tuneli, przepustów i konstrukcji oporowych. W obu częściach rozdziały poświęcone poszczególnym rodzajom drogowych obiektów inżynierskich zostały podzielone na podrozdziały. Tytuły podrozdziałów to jednocześnie nazwy ocenianych elementów, wymieniane w takiej samej kolejności, jak we wzorach protokołów przeglądów podanych we wspomnianym Zarządzeniu.

Zasady oceny stanu technicznego zostały omówione w czterech blokach. Blok pierwszy to wprowadzenie (tzw. preambuła) znajdujące się bezpośrednio pod tytułem podrozdziału. W bloku tym przede wszystkim doprecyzowano, które części obiektu podlegają ocenie wg danego podrozdziału i wskazano sposób postępowania w przypadkach nietypowych.
Blok drugi stanowi tablica z opisem uszkodzeń, które mogą wystąpić w ocenianym elemencie. Dla każdego rodzaju uszkodzenia zostały podane oceny oraz przykładowe kody. Wartość oceny uzależniono od zakresu uszkodzenia, jego wpływu na estetykę, trwałość lub bezpieczeństwo elementu/obiektu.
Blok trzeci to uwagi szczegółowe, które w niektórych przypadkach zostały poprzedzone uwagą lub uwagami ogólnymi. Uwagi szczegółowe podano w kolejności odpowiadającej uszkodzeniom wymienionym w bloku drugim, czyli w tablicy. Uwagi zawierają wyjaśnienia i doprecyzowanie zasad oceny, a także sposób postępowania w nietypowych przypadkach.
Blok czwarty stanowią przykłady uszkodzeń. Każdy przykład zawiera fotografię, krótki opis uszkodzenia, kody uszkodzeń oraz ocenę punktową.
W nowym wydaniu „Zasad …" wprowadzono jakościowo nowy sposób oceny rys w pomoście i dźwigarach o konstrukcji betonowej, i to zarówno w konstrukcjach żelbetowych jak i z betonu sprężonego. W elementach sprężonych ocenę stanu zarysowania uzależniono od stanu sprężenia elementu (sprężenie pełne, ograniczone, częściowe) oraz od systemu norm zastosowanych do jego projektowania (system norm wycofanych lub Eurokodów). Wyodrębniono rysy skurczowe, rysy wzdłuż korodującego zbrojenia, rysy przeciążeniowe oraz w stykach technologicznych.
W celu ujednolicenia sposobu oceny przydatności do użytkowania zestawiono tabelarycznie najczęściej występujące nieprawidłowości i/lub uszkodzenia ograniczające tę przydatność. Zamieszczono liczne przykłady, każdy przykład zawiera fotografię, komentarz i oceny.
Wyniki oceny stanu technicznego i przydatności do użytkowania są stosowane w GDDKiA m.in. w algorytmie szeregowania obiektów do napraw. Algorytm wykorzystuje sieci neuronowe i obejmuje obecnie ok. 8 tys. obiektów mostowych. Prawidłowe funkcjonowanie algorytmu jest możliwe tylko wtedy, gdy inspektorzy mostowi w całym kraju, te same uszkodzenia oceniają w taki sam sposób. Omawiane „Zasady…" pozwalają ujednolicić sposób oceny.
„Zasady…" uwzględniają najnowsze rozwiązania konstrukcyjne i materiałowe oraz liczne przykłady - łącznie w opracowaniu zamieszczono około 400 przykładów uszkodzeń obiektów mostowych oraz około 270 przykładów uszkodzeń tuneli, przepustów i konstrukcji oporowych. Podkreślono, że Inspektor mostowy znając „Zasady…" i oceniając stan techniczny oraz przydatność do użytkowania powinien się kierować głównie własną wiedzą i doświadczeniem. Powinien wnioskować ekspertyzę, ograniczyć nośność czy zamknąć obiekt dla ruchu nawet wtedy, gdy taka konieczność nie wynika z „Zasad…", a jest uzasadniona z uwagi na stan obiektu.

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