Inspection And Diagnostics Of Railway Reinforced Concrete Bridge In Andijan-Khanabad Peregon

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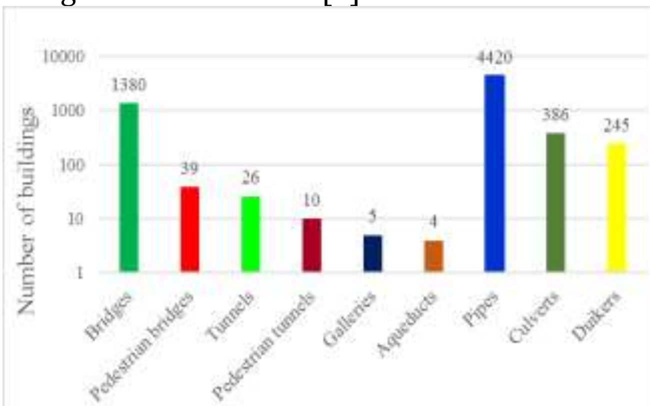
The article presents practical recommendations for determining the load-carrying capacity of the railway reinforced concrete bridge located at 346+605 km of the Andijan railway distance Andijan-Khanabad. To ensure the safety of vehicles, it is recommended to build a new bridge or replace the main part of the bridge.

Keywords: Bridge, operational period, diagnostics, defects and damage, reinforced concrete, monitoring, load class

Introduction Systems of transport facilities are the main part of the country's economy. Railway transport is likened to the lifeblood of the country's economy. In particular, among these transport structures, bridges differ from all other artificial structures according to their construction complexity and operation process [1, 2, 7]. Bridges, pipelines and other artificial structures operated on the railways of the Republic of Uzbekistan were built in different periods, starting from the end of the 19th century [3].

According to the data of 2019, the man-made structures at the disposal of the joint-stock company "Uzbekistan Railways" are as follows: 1380 bridges on main roads (reinforced concrete - 1307; metal - 48 and mixed - 25). There are 26 railway tunnels, 10 pedestrian tunnels, 39 pedestrian bridges, 5 galleries, 4 aqueducts, 4420 pipes, 386 culverts, 245 duikers. The total length of the bridges is about 41 km [4].



Graph 1. The number of artificial structures on the railways of our republic

It should be noted that reinforced concrete bridges are important nodes of the transport network within the railway and highway, agricultural and industrial sectors.

Keeping them in good condition is one of the main conditions for ensuring normal operation of traffic in the region [3].

Constructive, architectural and size-planned solutions of the bridge structure, as well as materials and equipment, which can be carried out during the construction period, should be technologically targeted during the current maintenance and reconstruction of the period of use (during repair) [7]. It is also necessary for bridges to ensure the safe movement of traffic at the specified speed [13]. Due to the man-made defects and damages during the construction period, as well as improper operation of the transport facilities and the increase in the loads from the traffic structure, their service life decreases over time.

Bridges, pipelines and other artificial structures operated on railways in the CIS countries, including the Republic of Uzbekistan, are designed and built under different design norms and different calculated loads [3, 5, 6]. Until 1962, the constructions were designed according to the permitted stresses, and after 1962, the limit state methods were used. According to the norm of 1962, in the form of equivalent loads, the normative perspective (prospective) load CK obtained as a unit from the effect of different types and combinations of rolling stock is provided. In the design of capital structures, K=14 class was adopted for CK load, and K=10 class for wooden bridges. 2.5K is assumed in the calculation of loads accumulated on the axis [3, 8].

The service life of bridges is on average 70-100 years, but this is also a relative indicator, and the service life of bridges depends on their operating conditions [6]. To date, most of the bridges are not able to provide the capacity and traffic conditions.

Setting the task. This article examines the inspection and diagnostics of the 346+605 km railway reinforced concrete bridge located on the Andijan-Khanabad railway section in Andijan region in 2022. For this purpose, it is necessary to identify existing defects and damages in the railway reinforced concrete bridge, and to analyze the condition of existing defects in each structural element of the bridge. As a result, the technical and operational condition of the bridge constructions is evaluated according to the load-carrying capacity, and the possibility of future exploitation is determined.

Inspection and diagnostic results. The reinforced concrete railway bridge of 346+605 km located on the Andijan-Khanabad railway section of the Andijan railway distance was built in 1915 according to the scheme of 3.08+5.27+5.36 m. The total length of the bridge is 23.07 m. In 1997, the bridge intermediate device №557 (typical project) was replaced with a slab reinforced concrete intermediate device with simple reinforcement, and it was calculated for the design load of CK 14 (Figures 1-3).

Figure 1. General view of the reinforced concrete railway bridge (right and left sides)

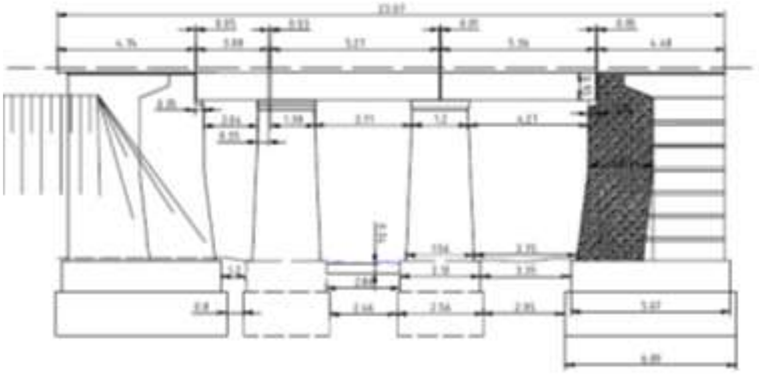


Figure 2. The facade of the reinforced concrete railway bridge

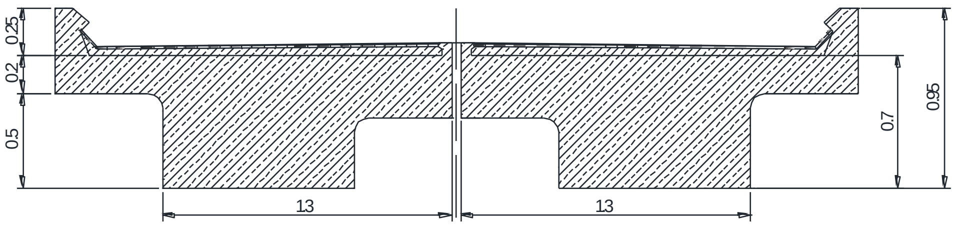


Figure 3. Cross-sectional view of the intermediate device

Intermediate and edge supports of the bridge are reinforced concrete composite monoliths. The constructions of the edge and intermediate supports of the bridge consist of cabinet blocks, truss plates and reinforced concrete contour blocks. The foundation consists of monolithic reinforced concrete blocks with a height of 1.06 m and 1.5 m, respectively. The foundations are located on natural ground, the distance from the under-rail level to the upper level of the foundation is 5.32 m (fig. 4). Base parts - metal sheets are laid.

The type of bridge deck is placed on ballast on reinforced concrete sleepers with elastic clamps, rail type R65.

Geodetic and other measurements were determined using a Trimble C5 5" electronic total station. The strength of the base and foundation structures was determined using a "Schmidt" sclerometer.

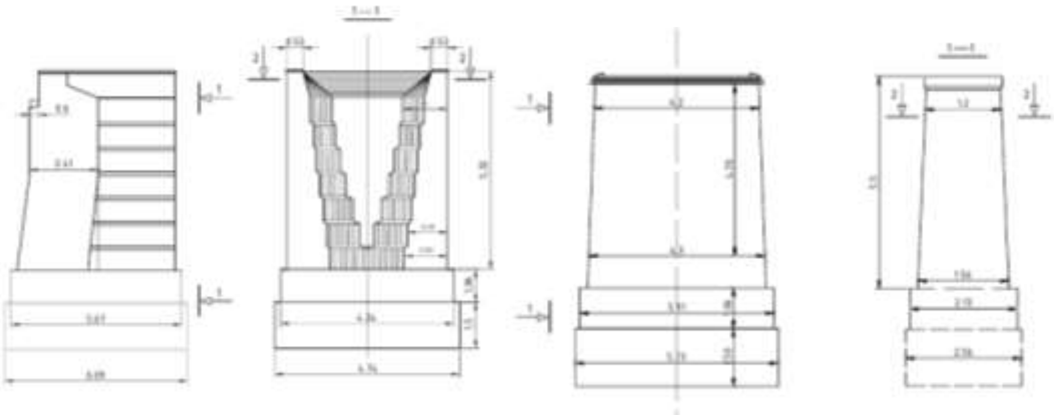


Figure 4. Edge and intermediate supports of the bridge

The following faults were identified as a result of diagnosis of the technical condition of the railway where the examinable railway

In the spans:

– In the zone near the deformation seams, there is partially damaged layer of concrete (Figure 5);

– Stroppies slots are not covered with concrete;

– water escape pipes are reduced or damaged;

– Metal sheets on longitudinal and transvegular deformation between the intermediate device blocks and are strongly corrosion (figure 6-7);

- Due to the flaw of metal sheet in the Andijan station on the side base, the ballast is down due to the defective state (not allowed according to norms);

- According to the results of the 110s, the interim device deviaes external intersections 20 mm. The building level deformations between the interval: Interventional device 1 in left beam - 38 mm; in the right beam - 58 mm; The second interim device is + 10mm; In the right beam - 44 mm. The plants of the intermediate devices appear on a different height of the intermediate devices due to deformers. The intermediate device hung on the middle of the middle.


Figure 5. Span - slap, reinforced concrete

Figure 6. Salinity

Figure 7. The place of water flow near and in deformation seams

In the bearings - base lists are corrected. In addition, metal sheets are clinging to the fields of reinforced concrete farms.

On the supports:– At the intervention base, there were more than 2.0 mm in horizontal cracks at the top of the pillar;

- The decline base is traces of water flow and the supports are vertically deformated;

- Farmed fields gravel and flaven bases were corrased with waste and deformation in demonstrations in foreign bases (Figure 8);

- Drain is partially damaged.

Figure 8. The appearance of the edge support № 4

Clicker-backed by the scores of the bridge position is the direction of its longitudinal axis, taking into account the faults, including intermediate supports in the top vertical degree The ability to lift up to the load is determined below.

The results of calculation of the bearing capacity of the edge support of the bridge. Classification of supports is carried out on the basis of basic provisions of the reliability of building structures and foundations for the limits of the first group (GOST 27751-88). The maximum intensity of a temporary equilibrium and maximum intensity of each account section is detected.

Vaccani base classes (1) on account range is calculated according to fluential formula, Generalized in Table 1.

The smallest class of the results obtained is found in the maximum pressure, taking into account the equal exercise exsentricity (taking into account the output of the equal exposure from the keim covenant) and is 4.29 [9, 11, 16].

$$K = \frac{k}{k_n(1+\mu)}$$

For the examined railway, the load class is determined by the following expressions of the maximum and average pressure of CK14. [11-15].

By average pressure

$$k = \frac{mnRA - \sum N_n}{\varepsilon_k n_k \sum \Omega_k^N} \quad (1)$$

By maximum pressure

$$k = \frac{mnRW - (\sum N_n p + \sum M_n)}{\varepsilon_k n_k (\sum \Omega_k^M + \sum \Omega_k^N p)} \quad (2)$$

Table 1

Amounts needed to calculate the foreign base class	Calculated values				
	By average pressure		By maximum pressure		
	Heel level	Upper level	Heel level	Upper level	taking into account the eccentricity of the effect
k	39,5	324,72	25,2	198,2	22,71
λ	4,86	4,86	4,86	4,86	4,86
λ_y	4,78	4,78	4,78	4,78	4,78
$(k_{Тл}^{H})$	4,19	4,19	4,19	4,19	4,19
$(1+\mu)$	1,40	1,40	1,40	1,40	1,4
K	**6,73**	55,3	**4,29**	33,7	3,87

* Equivalent cargo for lines of triangular-rectangular affected strips are considered to be α=0.5 in a position [8, 9] when loading on lines of triangle .

It is known that the lifestyle class of bridges decreases over time. In this table, we can see that the average pressure class at the footing level is K=6.73 and the maximum pressure class is K=4.29. As a result, on the line, according to [13], the speed of trains should be limited to 40 km / hour.

The lifting backstacks are determined by the following formula, the level of normative horizontal (sideways), which is based on the base of the bridge, as well as depth of 3 m or less depth of 3 m in depth or less than 3 m deep levels.

$$F_h = \frac{1}{2} p_h h_x b ,$$

(3)

Here is the normative horizontal (sideways) located at the bottom surface of the section in p_h - [8] of 2.6 - item [8].

The h_x - the lifting height of the rails or the upper part of the roadbed, m;

b - is the width of the base, which is given (on average height h_x), which is horizontal (sideways) the bridge distributed.

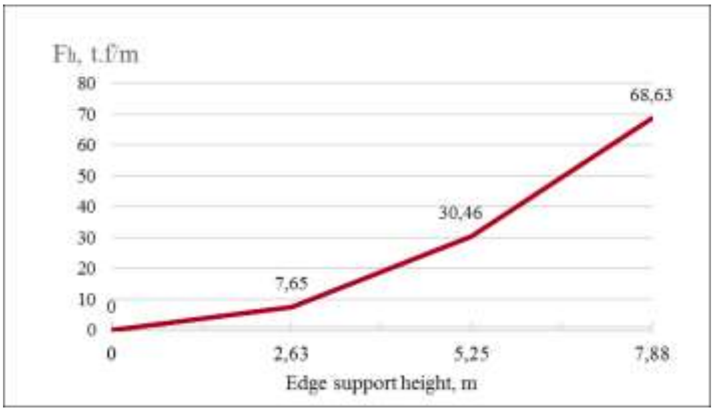


Figure 9. Graph The schedule of the grounding the normal pressure on the base base dependence on the base height

The graph can be seen that the ground is increasingly increases to the target horizontal pressure to increase the base height of the target. The base body of the ground pressure of the ground

Conclusion

The following conclusions are given based on the examination and diagnosis of the railway on the Andijan-Khanabad Peregon:

1. At the bottom of the bridge, due to the sharp difference in the surface of the water tube, foundation was carried out as a result of the speed of the water flow. From the bridge, the regulatory structures are not strengthened at the exit of water. At the bottom of the bridge, dams from gabions boxes were not organized enough to prevent erosion.

2. In 2015, a solid transmission and drainage in the basement 3 as a result of washing the foundations of the intermediaries. Intermediate devices 2 and 3 shifted accordingly on Tarex and profile. As a result, the base location of intermediate device blocks decreased by 18-20 cm long, and concrete cracks appeared before deformation seams.

3. The results of the calculation calculation of existing bridge-backs showed that the results of the lifting of the existing air bases have shown that there are vertical deformations and deviations that cannot be accepted on the interim supports. With this in mind, on the line is limited to 40 km / hour of trains.

4. Taking into account the presence of unacceptable vertical deformations and the roll of the intermediate support 3, a possible option for reconstructing the bridge into a single-span with the replacement of the existing spans with one ribbed span 14.3 m long is proposed.

5. Calculations of the abutment for carrying capacity with new ribbed span

structures 14.3 m long shows that the geometric dimensions of the platform of the truss and the bearing capacity of the abutments are not enough.

6. Given the presence of injuries in the operation and the bodies of both foreign and intermediate and intermediate supports, the geometric dimensions of the farm will be required in the longitudinal direction. It is recommended to build a new bridge or switch the main part of the bridge to ensure the security of vehicles.

References

1. O'zbekiston Respublikasi Prezidentining 2017 yil 4 oktabrdagi "Avtomobil yo'llari ko'priklarini, yo'l o'tkazgichlar va boshqa sun'iy inshootlarni qurish hamda foydalanishni tashkil etish tizimini takomillashtirish to'g'risida"gi PQ-3309- sonli Qarori.
2. O'zbekiston Respublikasi Prezidentining "Yo'l sohasini boshqarish tizimini yanada takomillashtirishga oid chora-tadbirlar to'g'risida"gi 2019 yil 9 dekabrdagi PQ-4545-sonli Qarori.
3. Raupov Ch.S., Shermuxamedov U.Z., Umarov X.Q. Transport inshootlarining ekspluatatsiyasi // Darslik. ToshdTrU. "Complex Print", 2020 y. 488 b.
4. O'zbekiston temir yo'llari tasarrufidagi sun'iy inshootlar bo'yicha ma'lumot. Yo'l xo'jaligi boshqarmasi. 2019 y.
5. Ергашев, З.З., Шермухамедов, У.З., & Абдукадыров, Ф.Э. (2017). Примеры технических реализаций мостов при продольных сейсмических колебаниях на высокоскоростных линиях. Журнал научных и прикладных исследований, 1(1), 72-75.
6. Шермухамедов У.З., Байбулатов Х.А., Исмаилов О.Т., Хамдамов У.Ю. Сирдарё вилоятидаги халқаро аҳамиятга молик автомобиль йўлларидаги кўприкларда табиий ва техноген халокатлар оқибатлари диагностикаси // Журнал "Механика муаммолари". – Тошкент: ИМиСС, Ўзбекистан. – 2020, №1-2. – 126-130 б.
7. Shermuxamedov U. Z., Zokirov F. Z. APPLICATION OF MODERN, EFFECTIVE MATERIALS IN RAIL ROAD REINFORCED BRIDGE ELEMENTS //Journal of Tashkent Institute of Railway Engineers. – 2019. – Т. 15. – №. 3. – С. 8-13.
8. ШНҚ 2.05.03–12. Кўприклар ва қувурлар. –Т.:ЎзР Давархқурилишқўм, 2012. – 452.
9. ШНК 3.06.07-08. Мосты и трубы. Правила обследований и испытаний / Госархитектстрой Руз, Ташкент, 2009.
10. КМК 2.03 11-96. Защита строительных конструкций от коррозии.
11. Руководство по определению грузоподъемности опор железнодорожных мостов. М., Транспорт, 1987.
12. Инструкция по содержанию искусственных сооружений. «Узбекистан темир йуллари». Ташкент. 2015.
13. Указания по определению условий пропуска поездов по железнодорожным мостам. М., 1983.
14. Указания по устройству и конструкции мостового полотна на железнодорожных мостах. – М., Транспорт, 1989.
15. В.О. Осипов, Ю.Г. Козьмин, А.А. Кирста, Э.С. Карапетов, Ю.Г. Рузин. Содержание, реконструкция, усиление и ремонт мостов и труб // М.: 1996 г. – 471 с.
16. Инструкция по текущему содержанию железнодорожного пути. ГИН 07-032-03. «Узгосжелдорнадзор». Ташкент. 2003.
17. Saidxon S., Fakhriddin Z., Nodirbek A. A NEW TYPE OF CONSTRUCTION OF THE CARRIAGEWAY OF ROAD BRIDGES USING NON-TRADITIONAL WATERPROOFING MATERIALS //Science and innovation. – 2022. – Т. 1. – №. С3. – С. 208-213.