1918
TALLINNA TEHNIKAÜLIKOOL
TEEDEINSTITUUT

TALLINN-TARTU MAANTEE KM 22,08 ASUVA VAIDA JALAKÄIJATE VIADUKTI REKONSTRUEERIMISE PROJEKT

RECONSTRUCTION PROJECT OF A PEDESTRIAN OVERPASS LOCATED IN VAIDA ON THE 22,08 KM OF THE TALLINN-TARTU HIGHWAY

ETS 60 LT

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Tallinn, 2015

9. Kokkuvõte

Antud diplomitöö raames on lahendatud eelprojekti mahus Vaida jalakäijate viadukti ümberehituse projekteerimise optimaalne variant. Käesoleva projekti eesmärk on Vaida jalakäijate viadukti ümberehituse projekteerimine tagamaks rajatisele järgnevaks 50 aastaks remondivaba ekspluatatsioon ning tõsta viadukti kõrgusgabariit vähemalt 6,0 meetrini.

Töö käigus uuriti Vaida jalakäijate viadukti ehituse ajalugu ja viadukti ekspluatatsioonil esile kerkinud probleeme.

Vaida jalakäijate viadukt nr. 150 asub riigimaanteel nr. 2 Tallinn-Tartu-Võru-Luhamaa km 22,08; Harju maakonnas, Rae vallas. Kolmeavaline liimpuidust vantsild on ehitatud 2008 aastal. Aastaks 2014 on ilmnenud viaduktil mitmed kahjustused. 5. augustil 2014 aastal vajus läbi viadukti kõnnitee käiguosa ning viadukt suleti ajutiselt.

Vastavalt töö lähteülesandele koostati viaduktile 10 erinevat arhitektuurset eskiisi. Nende hulgast valiti neist edasisteks arvutusteks kolm paremini sobivat varianti:

1. Klassikaline, lehviku kujuline, kahe sümmeetriliselt paigutatud vertikaalse püloonipaariga, kolmeavaline vantsild. Avapikkused on 31,0+62,0+31,0 meetrit.
2. Modifitseeritud lehviku kujuline, kolmeavaline vantsild, avapikkusega 31,0+51,7+41,3 meetrit. Asümmeetriliselt paigutatud püloon on viadukti ristlõikes tagurpidi V-kujuline, külgvaates ettepoole kallutatud Delta tähe sarnane.
3. Modifitseeritud lehviku kujuline, kolmeavaline vantsild, avapikkusega 31,0+51,7+41,3 meetrit. Asümmeetriliselt paigutatud püloon on viadukti ristlõikes A-kujulise, külgvaates tahapoole kallutatud pülooniga.

Seejärel tehti selgeks vantsilla projekteerimiseks vajalikud nüansid ja koostati projekt arvestades Eestis kehtivaid projekteerimisnõudeid.

Vaida jalakäijate viadukti pealisehituseks pakuti välja kolmeavaline vantsild, arvestades avade mõõtmeid, allesjäävate konstruktsiooniosade sobivust ja optimaalset lahendust ehitamiseks. Töö käigus valiti kandeelemendid ja teostati arvutused nende sobivuse kinnitamiseks.

Konstruktsiooniosade dimensioneerimiseks teostati üldised ja kohalikud arvutused. Üldised arvutused teostati lõplike elementide meetodit kasutava arvutusprogrammiga, mis andis tulemusteks elementide sisepinged. Pingete alusel valiti elementidele sobilikud ristlõiked milledest osade sobivust kontrolliti hiljem kohalike arvutustega kõige ebasoodsamate koormusvariantide koosmõjule.

Peale materjalide ja konstruktsioonielementide lõplikku valikut tehti viadukti rekonstrueerimise majanduslik arvestus. Selle tulemusel saab järeldada, et konstruktsiooni variant nr. 1 on majanduslikult kõige ratsionaalsem kuna see kasutab kõige enam ära allesjäävaid konstruktsioone (olemasolevad sambad vajavad minimaalset juurdeehitust). Teisel ja kolmandal variandil tuli üks vahesammastest täielikult ümber ehitada ja ka pülooni kõrgus neil variantidel on suurem.

Juhul kui viadukt läheks täielikult ümberehitamisele, ei oleks esimese variandi majanduslik eelis nii selge. Arhitektuursest vaatepunktist on variandid 2 ja 3 huvitavamad ning lõplik lahendus sõltub seega tellija valikust.

Antud teema ja lahenduskäik andis parema nägemuse projekteerimise käigus ettetulevatest probleemidest ja nende lahendamise võimalustest. Täiendati erinevate materjalide, eriti Eestis kehtivate standardite ja erinevate programmide kasutusoskust. Kasutatud projekteerimistarkvara ja arvutusprogrammi kasutati erinevate võimaluste tundma-õppimiseks ja oskuste lihvimiseks keeruliste staatikaga määramatute konstruktsioonide lahendamisel. Tänu antud lahenduskäigule saavutati usaldusväärsed tulemused optimaalse ajakuluga.

10. Summary

Reconstruction project of a pedestrian overpass located in Vaida on the 22,08 km of the Tallinn-Tartu highway

Within the framework of this graduation thesis the optimal version of a reconstruction project of a pedestrian overpass located in Vaida was found. The goal of this project is to plan the reconstruction of the pedestrian overpass in Vaida with the following 50 yearlong repair-free operation and to raise the vertical clearance of the overpass to the minimum of 6 meters.

In the course of work the construction history of Vaida overpass was examined and certain operational problems became evident.

Vaida pedestrian overpass nr. 150 is located on the 22,08 km of Tallinn-Tartu-Võru-Luhamaa state highway; in Harjumaa county, in Rae parish. The cable-stayed timber overpass with three apertures was built in 2008. By the year 2014 several damages have appeared on the overpass. On the 5th of August in 2014 the overpass sidewalk sank and the overpass was temporarily closed.

According to the initial working tasks 10 different architectural sketches were designed for the overpass. From their amount the three most suitable options were selected:

1. Classical, fan-shaped, three-aperture, cable-stayed overpass with two pairs of vertical pylons installed symmetrically. The heights of the apertures are 31,0+62,0+31,0 meters.
2. Modified fan-shaped, three-aperture, cable-stayed overpass with the heights of the apertures equal to 31,0+51,7+41,3 meters. Assymetrically installed pylon is V-shaped upside down in the overpass cross-section and similar to a forward-inclined Delta letter in the overpass side view.
3. Modified fan-shaped, three-aperture, cable-stayed overpass with the heights of the apertures equal to 31,0+51,7+41,3 meters. Assymetrically installed pylon is A-shaped in the overpass cross-section and with a backward-inclined pylon in the overpass side view.

Then the necessary nuances for a cable-stayed overpass design were clarified and the project was compiled taking into account the design requirements applied in Estonia.

A three-aperture, cable-stayed overpass was offered as a superstructure of Vaida pedestrian overpass taking into account the sizes of the apertures, suitability of the remaining parts of the structure and the optimal solution for construction. In the course of work carrier elements were selected and calculations were made in order to confirm their suitability.

General and local calculations were carried out for dimensioning the parts of the structure. General calculations were made with a program that uses the final element method, which gave the internal stresses of the elements as results. The suitable cross-sections of the elements were selected based on the stresses. The elements with the selected cross-sections were later controlled by local calculations for the combined effect of the most unfavorable loads.

After final selection of the materials and structure elements economic calculation of the overpass reconstruction was made. As a result, it is possible to conclude that the first option of the structure is economically the most rational since it uses the most of the remaining structures (the existing columns require minimum extension). In case of the second and third options it was necessary to completely reconstruct one of the intermediate columns and the height of the pylon is also larger in case of these options.

In case the overpass was to undergo a complete reconstruction, the economic advantage of the first option would not be as clear. From the architectural point of view the second and third options are of more interest, and thus the final solution depends of the customer’s choice.

The given topic and the solution course gave a better vision of the upcoming problems in the course of design and the possibilities for their solution. The skills of using different programs and different materials, especially the standards applicable in Estonia were complemented. The design software and the calculation program were used for searching different possibilities and polishing skills in calculation of complicated statically undefined structures.

Due to the given solution course the reliable results were achieved with optimal time expenditure.