Tacis Regional 2000 Traceca Programme

Rehabilitation of Caucasian Highways

Azerbaijan, Georgia and Armenia

Construction of the Gasan Su Cay and Shemkir Cay bridges in Azerbaijan - Contract EUROPEAID/112944/C/W/AZ

Supplementary Design Review Report

No: (TRP / 1 / 2003 / AZ)

September, 2003

EUROPEAID CO-OPERATION OFFICE

This Project is funded by the European Union

A technical Support Project By Louis Berger SA

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Rehabilitation of Caucasian Highways
Azerbaijan Georgia and Armenia

EUROPEAID/113179/C/SV/MULTI

This Project is funded by the European Union

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Traceca Coordination Team
Baku

7th September, 2003

Subject: **Supplementary Design Review Report**

For the attention of Mr. Marc Graille

Dear Sir,

Please find attached the Supplementary Design Review Report (TRP/1/2003/AZ) provided by the Short Term Bridge Expert, regarding the construction of the 2 bridges Contract. The soft copy in the CD is also being attached.

Yours Sincerely

Razek Degheim
LBSA Team Leader/ Project Manager

Enc: - hard copy (1 document);
- CD (1);

JACOBS

REHABILITATION OF CAUCASIAN HIGHWAYS

Construction of Bridges at Gasan Su Chay and Shemkir Chay - Azerbaijan

Supplementary Design Review Report

September 2003

Revision 0

JACOBS

Document control sheet Form IP180/B

Client: Louis Berger s.a.
Project: REHABILITATION OF CAUCASIAN HIGHWAYS Job No: J23147A
Title: Supplementary Design Review Report – Shemkir and Gasan Su Chay Bridges

	Prepared by	Reviewed by	Approved by
ORIGINAL	NAME **J L Rigby**	NAME **T M H Cheeseman**	NAME **R F Finch**
DATE **1 October 2003**	SIGNATURE	SIGNATURE	SIGNATURE

REVISION	NAME	NAME	NAME
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Contents

1 INTRODUCTION

This report describes the progress on the design and construction of the Gasan Su and Shemkir river bridges made since the initial visit of the Jacobs technical expert on bridges, which took place in April 2003. Shemkir Chay Bridge is located approximately 10km west of the city of Ganja, and Gasan Su Chay Bridge is a further 60km along the project road in the direction of the Georgia border.

The report was prepared following discussions with the Louis Berger project manager and resident engineer, visits to the two bridge sites by the Jacobs technical expert, and a technical meeting with the contractor's designers.

Construction has commenced and significant progress has been made on the foundations at both sites.

Technical issues raised in the Jacobs report on the first visit have been addressed by the designer and contractor "Azerkopru" and the responses have been reviewed by an appointed independent expert. This report examines the responses and draws conclusions about the result of the technical design process.

Two specific technical issues have transpired at the commencement of the construction process, relating to problems with the construction of foundations at Shemkir and Gasan Su bridges. The issues are described in this report and a conclusion reached on a satisfactory response, which will allow work to proceed.

2 PROGRESS

On 24 July 2003 permission was granted by the Azerbaijan state construction and architecture committee for work to begin on the two bridges. Construction has now commenced at both the bridge sites.

At Gasan Su Chay Bridge, the end supports (abutments) have been concreted to the column seating level. Excavation of the existing piles has taken place. These piles were installed in an abortive bridge construction contract about 15 years ago. The Contract intended that the piles should be exposed and used to support the intermediate piers in the current construction. The condition of these piles has led to the first technical issue, which is discussed later in the report.

Piling equipment for the installation of proposed replacement piles was on site at the date of the visit (24 September 2003).

At Shemkir Bridge, construction of both end support bases, involving placement of 160m^3 of concrete has been completed and the pre-cast support columns placed in position. The test results on this concrete have led to the second technical issue, which is discussed later.

Following difficulties with ground water during excavation for the end support bases, the contractor has elected to introduce piles to limit excavation requirements at the intermediate supports. These will be 530mm diameter reinforced concrete driven piles, 10 No. per base. The piles have been cast and are currently curing for 28 days prior to installation.

A substantial number of the pre-cast beams required for deck construction have been delivered to site, along with two pre-cast cross heads and the pre-cast piers for the intermediate supports.

It was observed during the site visit that the workers had been issued with, and were using, basic personal protective equipment: hard hats and high visibility jackets. This was not generally the case with the supervisory staff. The sites appeared to be clean and orderly.

3 CONSTRUCTION PROBLEMS

3.1 GASAN SU CHAY BRIDGE: PILING

The Contract anticipated that the existing piles, installed 15 years ago during an aborted bridge reconstruction contract, would be exposed and used as supports to the current construction.

Upon excavation, a number of problems were discovered with the piles, which has led to concerns about their competence to support the bridge loads. In brief, the problems reported were:

- The installation was not in compliance with SNIP standards in that the pile spacing was insufficient. SNIP 2.02.03-85, Item 7.9 requires pile spacing minimum 1.0m whereas actual installed spacing varies between 57cm and 90cm.
- The protective layer (i.e. cover to reinforcement) was as little as 15-20mm whereas the SNIP requirement is 50mm
- The concrete quality appears to be poor, having been made with river aggregates and the best estimates of grade according to some calibrated Schmidt tests is B7,5 to B12,5. Grade B25 should be the minimum considered for reinforced concrete piles.

On discovering these defects, the contractor "Azerkopru" convened a technical committee which concluded in its report dated 20 August 2003 that the existing piles were not acceptable for inclusion into the new bridge. A local bridges expert commissioned by Louis Berger, Mr. S. Safarov, verified the conclusion of the report in his note to the Resident Engineer dated 5 September 2003.

The Jacobs technical representative was able to observe three exposed piles in one pile group during a site visit on 24 September 2003. Further to the observations above, it was noted that:

- The piles were approximately 500mm diameter, not 730mm as stated in the Contract
- The reinforcement cages were badly positioned within the pile casing
- Almost all the continuity reinforcement projecting from the piles had been broken off.

There are further doubts about the supervision of the original pile installation and no credible records of their length. Therefore, our view agrees with that of Azerkopru's committee and Mr Safarov, that the risk of using the existing piles in the new construction cannot be justified.

Azerkopru has put forward a draft solution to install two new 1.2m diameter bored concrete piles at each intermediate support to take the bridge loads. The existing piles will be abandoned. The system was agreed in principle but there remained some technical issues that needed to be resolved.

The proposals were discussed at a meeting held on 26 September 2003 between Azerkopru's designers, the Jacobs technical expert, the Louis Berger resident

engineer and the local independent bridges expert. The two major issues discussed were the proposed length of the piles and their structural reinforcement.

Azerkopru were able to demonstrate that they had followed the correct procedures for the design of the piles in accordance with the SNIP standard for pile design. They had taken into consideration the presence of ground water in the excavation and the requirements for seismic action. A ground investigation, which was concluded 20 years ago, was used as the basis for establishing the permissible ground pressure R used in calculation of the pile resistance. A value of 10 kg/cm^2 (100t/m^2) was determined from this investigation, but this was reduced to 6 kg/cm^2 in the KOCKS GmBH report, though apparently no further site investigation was carried out. The figure appears to be conservative, but the provenance of the original investigation remains uncertain.

The pile length of 10m appears correct on the basis of information available, but as a further safeguard we recommend that an engineer with geotechnical experience is present on site to agree that the material at the bottom of the pile excavation is consistent with that assumed in the calculation and that provision should be made for extending the piles should inferior material be found.

Azerkopru demonstrated the procedure for establishing the reinforcement quantity used in the piles. The quantity appeared to comply with the standards. The designers stated that there is no requirement for a minimum percentage of reinforcement steel in piles according to the SNIP standard as is the case in some European standards. The Jacobs' technical expert accepted this statement.

Azerkopru prepared and issued amended drawings following discussion of the above. These were reviewed by the Jacobs technical expert on 27 September 2003 and found to be generally satisfactory though a few minor inconsistencies were observed and reported. The Louis Berger project manager wrote to the designers on 29 September 2003 noting the corrections that need to be made.

3.2 SHEMKIR BRIDGE: CONCRETE GRADE FOR END SUPPORTS

Concept designs for this bridge were produced by KOCKS Consult GmBH of Germany. Azerkopru's designers then produced working drawings and quantities. In producing the drawings and quantities, the grade of concrete stated for the end support bases was B25. For large foundation structures of this type, the appropriate concrete grade would be B15. The use of B25 is taken to be a mistake in the document production rather than an actual technical requirement.

In the event, cube tests on the concrete cast have shown that the requirements of B25 have not been met. Test results, following appropriate statistical modification, are summarised as follows:

1st stage (87m^3)	23 days	28 days
	19.5 N/mm^2	21.0 N/mm^2

2nd stage (72m^3)	21 days	28 days
	22.0 N/mm^2	23.5 N/mm^2

The 28 day requirement for B25 according to standards is 30 N/mm^2

In large concrete blocks such as these, there is no necessity for high grade concrete. In fact, it is often beneficial to keep the concrete grade lower, reducing cement content hence the heat of hydration produced and reducing the thermal strains to be resisted. The test results are comfortably adequate for grade B15 concrete (20 N/mm^2 at 28 days).

The issue was discussed at the technical meeting with Azerkopru's designers on 26 September 2003. It was demonstrated to the satisfaction of the Jacobs expert that standard foundations of this type require M200 concrete (equivalent to B15).

Our judgement is that there is no technical reason why the concrete as placed should not be accepted. Contractual issues relating to pricing are deemed to be the responsibility of the project control team. It is suggested that a price reduction appropriate to the reduced cement content of B15 concrete would be appropriate.

4 RESPONSES TO COMMENTS IN JACOBS' FIRST REPORT

It appears that comments related to design philosophy and the application of Western European standards cannot be implemented on this project. The Contract states that designs appropriate to local construction and standards should be used. It is noted that the designs are very economical and utilitarian and that durability detailing does not approach modern European standards. In particular, seismic detailing appears primitive and the integrity of the structures following a major earthquake or flooding event is questionable. This cost versus risk issue is a part of local judgement. It should perhaps be an aspiration to improve standards as the economy of the region develops.

Azerkopru has prepared a document "Answers to the Questions" which contains their responses to the design and constructability issues in the "Project Specific Recommendations" in the Jacobs' Design Review Report dated June 2003. Mr S Safarov, an experienced independent local bridge engineer retained by Louis Berger, has reviewed the responses. In his memorandum dated 5 September 2003, he confirms that aspects of design where questions were raised, relating to beam deflection, crack control and structure modelling are in compliance with the appropriate SNIP standards. Jacobs does not propose to raise further questions on matters of detailed design. It is accepted that the design stage has been passed and that normal local procedures have been adhered to in respect of the production and verification of the design. Detailed questions made without intimate knowledge of the local codes will, at this stage, be pointless.

On the particular constructability issue raised regarding seating the beams on the cross-heads, it is noted that the bearing plinths have been made larger but they are still insufficient to support the main beams during erection. Azerkopru state that they will attach steel cantilever brackets to the cross-heads to facilitate beam erection. This seems an instance where a small redesign, as recommended in Jacobs' earlier report, would have saved considerable construction cost and difficulty. We observe that erection of long pre-cast beams, which will be unstable until connected by the in-situ concrete, can be a dangerous operation. We strongly recommend that the erection method is reviewed with the Resident Engineer before commencement and that adequate temporary bracing is in place to ensure stability.

The designs for the bridges, with the piling issues at Gasan Su Chay Bridge having been resolved, are now accepted as appropriate to the Contract brief.

5 CONCLUSIONS AND RECOMMENDATIONS

Construction of the two bridges has commenced and considerable progress has been made on the foundations and on the manufacture of pre-cast components.

At Gasan Su Chay Bridge, technical problems in respect of the use of existing piles have been identified, discussed and resolved with an agreement to install new piles to take the bridge loads at the intermediate supports. The design of the new pile system has been reviewed, discussed and accepted. We have recommended that independent expert supervision should be in attendance during pile installation.

At Shemkir Bridge, an issue relating to concrete grade has been resolved from a technical viewpoint. It is accepted that the foundations, cast with lower grade concrete than specified on the drawings, still comply with standards. Payment issues are beyond the remit of this report.

We are satisfied that the designs for the two bridges meet with the requirements of local standards, but we have made observations about the limitations of these standards.

We have drawn attention to the potential dangers in erecting pre-cast beams, which will be unstable until connected by the in-situ concrete. We recommend that a method statement for a safe erection procedure is prepared and discussed with the Resident Engineer before commencing the work. Safety procedures for the piling operations at both bridges should also be planned and approved.

We have observed that basic site safety procedures are in place. It is recommended that procedures be extended to include supervisory staff and visitors.

Final drawings for both bridges have been received, reviewed and accepted with some minor comments on the Gasan Su Chay Bridge submission.

We believe that the design technical issues have been satisfactorily resolved and that construction can proceed with appropriate attention to detail and safety.

Appendix A - Supporting Documents

Document 1	Approval to commence construction
Document 2	Report by Azerkorpu's committee on existing piles at Gasan Su Chay Bridge
Document 3	S. Safarov's (local technical expert) review of Azerkorpu committee findings
Document 4	Drawing showing new piling arrangement at Gasan Su Chay
Document 5	"Answers to the Questions". Azerkorpu's designer's responses to the comments made in the Jacobs' (initial) Design Review Report
Document 6a	S. Safarov's review of the responses made by Azerkorpu to Jacobs' comments on Shemkir Chay Bridge
Document 6b	S. Safarov's review of the responses made by Azerkorpu to Jacobs' comments on Gasan Su Chay Bridge

Azerbaijan Republic State Construction and Architecture Committee
State Main Experts Department GOSSTROY

DOCUMENT 1

Approved by:
Head of The State experts Department

A.A.Geydarov

Recommendation

24 July 2003 year	No.4467/3331
Documentation type :	Working draft
Name and location (place) of construction	Construction of "Hasansu chay and Shamkir chay" Bridges
Contractor	"Azeravtoyol"State Company
Designer	JSC"Azerkorpu'
Principal Project Engineer	N.B.Aliyev
Financial Source	At the expense of Investment
Cost of submitted construction	Not available

Documents submitted to the Main State Experts Department by "Azeravtoyol" company on basis of letter No.01/573 19.06.2003 year:

- Geological- technical calculations – reviewed by "Azeravtoyol"SC.
- Technical calculations of bridges.
- Working draft- 2 albums.

Brief characteristics of accepted decisions

For Hasansu chay Bridge :

The bridge is designed according to scheme 3x18m by length 60,2m. Continuos roadway is placed on the span. The expansion joint is considered for only extreme shore support. Span construction designed from ordinary reinforced concrete, in the form of "T" according to the project type No.22155 inv. Intermediate supports are designed as a double poles structures and installed on the piles with grillage-concrete.Extreme supports are designed as a double post construction on the soil foundation.

The structure of ganging in accordance with type project No.14899 inv.

Water allocation structures are slope type d= 20sm consist of reinforced concrete facing slab. Tepperature joint of dimension 6,0x4,0m is installed in a slab. The cone

shall be filled with sandy gravel and leveled evenly around shore supports and compacted.

For"Shamkir chay"bridge:
The bridge is designed according to the scheme 3x22.2m by length 72,70m. Continuos roadway is placed on the span. The expansion joint is considered for only extreme shore supports. Span construction designed from ordinary reinforced concrete in accordance with typical project of series 3.503-27, inv.No.856.Extreme supports designed as a double poles structures on pile footing. The structure of ganging according to the type project No.14899 inv. The cone shall be filled with sandy gravel and leveled evenly around shore supports and compacted.

The Bridges project issued in accordance with CN and R 2.05.02-85, 2.05.03-84, III-7-81,2.02.03-85,2.03.01-84.
The Bridges accounted for the temporary norm loads A 11 and HK-80. During technical calculation 8 grade of seismicity took into consideration.

Followings were identified during revision of submitted documents:

1.For Bridges.

"Hasansu chay"Bridge:

1. The intermediate supports designed on basis of piles, which construction started at past and then continued.The load lifting ability of pile basis should be checked by static method before constructing of grillage on the piles. Additional excavated and filled piles should be checked if the load lifting ability is less than required.

"Hasansu and Shamkir chaylar"Bridges:

1.2. The crossing stabs that constructed from monolith concrete shall be divided into two parts for the Bridge axis and placed at the slope of Bridge access roads edgewise.

2.For the Bill.

2. N/A because of absence bill documentation.

3.General part.

3.1. Working draft is agreed by Main Fire Safety department Recommendation № 97 date of 14.08.2001, Republic Center of Hygiene and Epidemiology letter No. 4/22-564 date of 29.08.2001, Main Road Police Department letter 7/2285 date of 22.08.2001. The Requirement of Clause 6.1 of Recommendation No. 3331 is eliminated.

RESULT:

Taking into consideration that there are no remarks related to the working project of "Construction of Hasanchay and Shamkir Bridges", it is allowed to start construction taking into account the requirement of Cause 1.1 of the given recommendation.

Chief Deputy of Main Department:	S.E.Pashayeva
Chief of Construction Project Experts:	B.S.Guseynov
Expert out of Standard	S.H.Safarov

DOCUMENT 2

Azərbaycan Respublikası
AZƏRKÖRPÜ
Səhmdar cəmiyyəti

The Azerbaijan Republic
AZERKORPU
Joint-stock company

№ 806 «12» avqust 2003

To:
Luis Berger – Azerbaijan
72 / 4 Uzeir Gadjibekov str.

From:
«Azerkorpu» JSC
179, Azadlig ave.

To Mr.Dotchev attention

Shemkir chay and Hasansu chay Bridges reconstruction.
Europe Aid Project /112944 / C / W / AZ /

Dear Sir!

We want to inform you that a committee was organized by JSC «Azerkorpu», which visited Hasansu chay River Crossing site and examined the existing pile field with driven piles.

We send you pile survey act.

We also send you our constructive decision on intermediate supports № 2 and № 3.

In case the assumed version is accepted, we will render all the additional calculations and drawings.

Appendix:

1. Piles survey act.
2. Hasansu chay bridge crossing general view.
3. Intermediate support general view.

Best regards,
Chairman of
JSC «Azerkorpu»

Ismiyev Efendi

Received
19/9/03

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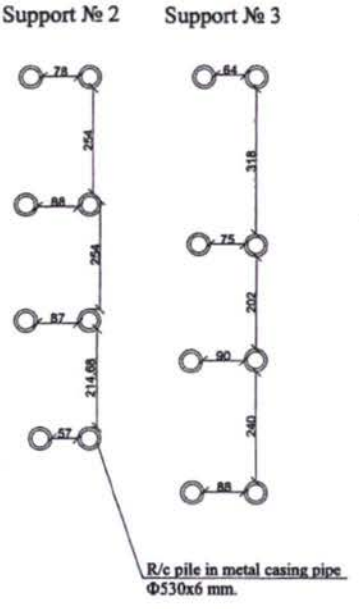
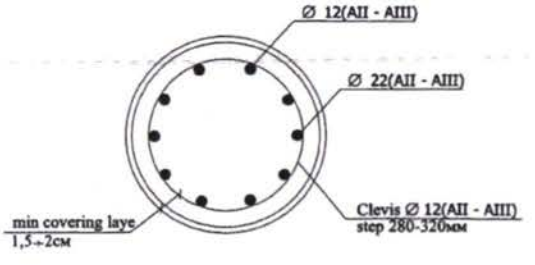
Ünv: Bank: ABB Abşeron filialı, Kod-805250; VÖİN 990000213; m/h 0137010002031; SWIFT: IBAZAZ2X;
h/h ABS-328021 AZM -3806-01; VÖİN müəssisə 100056083
Bank: Neqliyyat-Tikinti filial Azərneqliyyatbank KB; Kod 508018; VÖİN 100006518; m/h 0137010036031; h/h

Piles examination for
intermediate supports № 2 and № 3 of Hasansu chay bridge.

1. Actual dimension of pile field.



2. Piles reinforcement (along reinforcement expulsion from the crown of pile)



3. Concrete. Gravel concrete, fraction dimension is 10-200 mm.
Concrete actual class by Shmidt's skeptometer indication is M 80-M 120.

4. Conclusions about opportunity of exsiting pile fields utilization for intermediate supports erection.

4.1. Actual dimension of pile fields do not correspond to SNIP requirements 2.02.03-85 « Pile Reinforcement» , Clause 7.9 - clear distance between piles should be no less than 1,0 m, see Clause 1.

4.2. Minimal value of protective layer in piles should be no less than 50 mm, see SNIP 2.05.03-84 «Bridges and Tubes», Clause 3.120, actual protective layer is 15-20 mm, that does not correspond to GOST standards on filler (aggregate) and to SNIP requirements on toughness, see Clause 3.18-3.23.

4.3 In constrction of bridges concrete class M 250 by GOST 25192-82 should be utilized. Exsisting concrete does not correspond to the GOST standards on filler (aggregate) and to SNIP requirements on toughness, see Clause 3.18-3.23.

Conclusion: Given piles can't be utilized for bridge support erection.

Main expert JSC «Azerkorpu»	Orlov Dmitriy.S.
Chief of the laboratory JSC «Azerkorpu»	Nasrullayev Malik D.
Foreman JSC «Azerkorpu»	Mamedov Vahid
Representative from «Luis Berger»	Mamedov Kerim
MSU-2 foreman	Gurbanov Yagub

DOCUMENT 3

LOUIS BERGER – Azerbaijan
72/4, Uzeir Gadjibekov str.
Att for: Mr. S I Dotchev

I would like to inform you that "Azerkorpu" JSC has organized the special committee on the checking of the existing pile field with the drive piles condition, and determined:

1. distance between piles does not correspond to the requirements of SNIP 2.02.03-85 "Piles Foundation", Item 7.9. It should not be less than 1,0m.
2. the actual protective layer is 15÷20mm, but according to SNIP 2.05.03-84 "Bridges and Pipes", Item 3-120 should not be less than 50mm.
3. concrete in metal frame is not qualitative, it is prepared from gravel-pebble filler. Dimension of filler fraction is 10÷200mm. The actual concrete trademark according to Schmidt's apparatus display is within B 7,5÷B 12,5.
   Existing concrete does not correspond to the GOST standard 25192-82 neither by fillers nor by concrete trademark.

Taking into consideration the above mentioned, I notify that the existing pile field could not be used as a basis for foundations of the designed bridge piers.

I have checked in details the calculations for the new piles designed by "Azerkorpu" JSC. The checking has determined that piles design is done in accordance with SNIP 2.02.03-85 and can stand the loading from spans, crossbeams, pier walls, grillage and piles as well.

I would like to note that it is no need to pull out the existing piles that will result in basis weakening under the new pile.

SPECIAL NOTES:

In due time "Azerkorpu" JSC taking into consideration survey materials, has determined that the allowable nominal resistance onto piers foundation soil is 80 t/m² while preparing Tender Documents done by "KOCKS" company, in order to increase the safety margin the nominal resistance onto foundation soil was decreased to 60 t/m².

"Azerkorpu" JSC in its calculations has accepted 60 t/m² for the nominal resistance to the foundation soil, as it was given in Tender Documents.

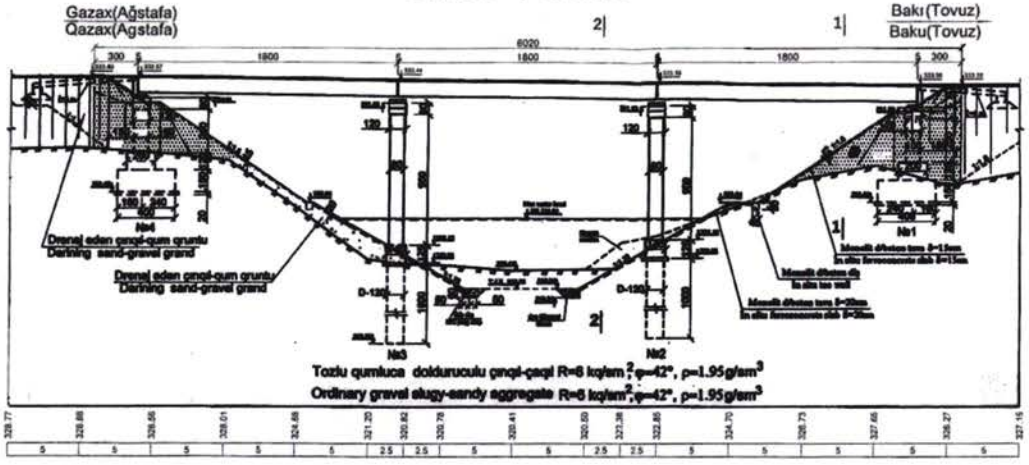
CONCLUSION:

New piles designed by "Azerkorpu" JSC can be accepted for construction.

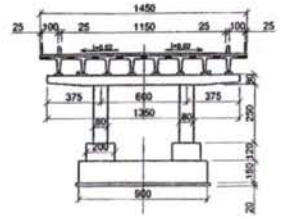
Chief Bridge Expert: S. Safarov

5.09.2003

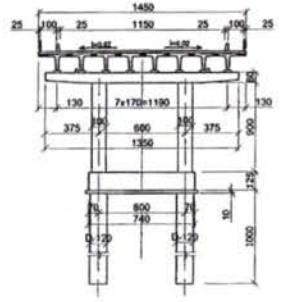
Fasad Fasade



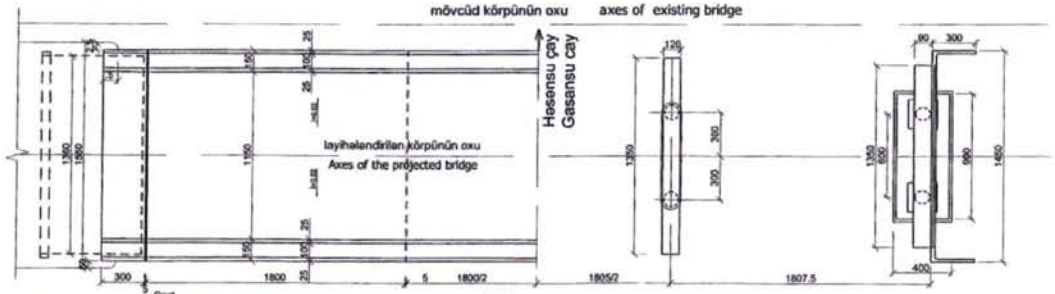
Section 1-1
Kəsik 1-1



Section 2-2
Kəsik 2-2



Plan Plan



Qeyd

1. Körpü 3x18m sxeminda L=60,2m uzunluğunda layihələndirilmişdir .
2. Ayrımda kəsilməz gedliş hissə yaradılmışdır . Deformasiya birləşən yalnız kənar dayaqlar üzərində nəzərdə tutulur
3. Ağırın birləri adi armaturlu d/betondan, T-şəkilli olub 22155 inv. №-li tip layihəsinə uyğundur .
4. Orta dayaqlar iki dikərli konstruksiyada olub qazma aveq esas üzərində qurulur .
5. Kənar dayaqlar iki dirəkli konstruksiyada olub təbii esas üzərində qurulur .
6. Keçid hissə konstruksiyaları 14899 inv. №-li tip layihəsinə uyğundur.
7. Körpü A-11, NK - 80 müvəqqəti yük təsirə 8 bal seysmikiyi nəzərə alınaraq hesablanmışdır.
8. Sutənzimləyici quğular yamac tipli olub δ=20sm d/beton odluk təvazimdən ibarətdir. Tavada 8,0x4,0 m ölçüdə temperatur birləşməsi qoyulur.
9. Konuslar çınqıl-qum qrunlunu kənar dayaqlar etrafında bərabər yayaraq kipləşdirməklə düzəldilir
10. Ölçülər "sm"-lə , yüksəkliklər "m"-lə verilib.

Note

1. The bridge was designed according to scheme 3 x 18m by length - 60.2m.
2. There was placed continuous roadway on the span. The Expansion joint is considered for only above shore supports.
3. Beams of span structure are T type and designed particularly of normal (usual) reinforced concrete.
4. Intermediate supports are designed as a of double-post structures on exiting piles by concreting of reinforced concrete capping.
5. Extreme supports are designed as a of double-post structures on soil foundation.
6. The structure of gauging with embankment corresponds to standard design - inventory no. 14899.
7. The bridge is designed under temporary load A-11, NK-80 taking into attention the seismic of 8 grade.
8. Water allocation structures are slope type d=20sm and consist of reinforced concrete facing slab.Expansion joint of dimension 8,0x4,0 are planed in a bias.
9. The cone shall be filled with sandy gravel and levelled evenly around shore supports and compacted.
10. The sizes in "sm", elevations in "m"

Həsənsu və Şəmkir çay körpülərinin tikintisi				
Construction of bridges - Hasan Su and Shamkir chai				
Sədr	İsmayıl O.			
Chairman	İsmayıl E.			
LBM	Əliyev N.			
PCS	Aliyev N.			
Baş konstruktor	Badirov M.			
Chief designer	Badirov M.			
İcraçı	Əliyev R.			
Executor	Aliyev R.			
Gasan su Cay Bridge / Həsənsu Cay körpüsü		Mərhələ Stage	Vərəq Sheet	Vərəqlər Sheets
		1L.	3	23
Körpünün ümumi görünüşü / General view of the bridge		A.T.S.C."AZƏRKÖRPÜ" J.S.C."AZERKORPU"		

DOCUMENT 4

DOCUMENT 5

Answers to the questions.

Shemkir Chay Bridge.

1. Beam Fixing on the piers.

The installation of the beams L = 21, 2m on the piers with axis distance between the piers 22,2m will be done with the usage of the additional metal cantilevers, adjacent to the cross- beam, as 10cm of needle beam on the cross beams is not sufficient.

2. Model

The theoretical base of PK "Lira – Windows" is the method of the finite elements (MFE), realized in the position of moving: KX= P
After it, we find vector X, then the other components of the strain and stress distribution. The main benefit is that we get matrix K and vector P by summarizing of the applicable stiffness matrixes and load vector, abiding for separate finite elements.
Have been used the following type of the finite elements: universal extensional bar (column, piers, cross- beams, beams) and universal extensional grid square element of the cover (slab of the carriageway).
All piers restrained in the foundation by the following axis: X, Y, Z, UX, UY, and UZ.

All hitches of the finite elements are banded with each other and it is fixing out the continuity of the element sections.

3. Reinforcement of the beams with the working reinforcement ⌀ 32 is given in the checklist document series 3,503 – 27 inv No 856 with the cracking resistance (design attached)

4. Maximum span deformation

The vertical span fixing of the highway bridge shall be no more than 1/ 400 L, m SNIP 2.05.03 – 84 "Bridges and the culverts" item 1.43 where L is the effective span: [f]= 22,2/400= 55,5mm

Taking into account the combined action of the span slab with back of the beam the maximum deflection constitutes 41,4mm (of the permanent loading 23mm, of the temporary 18,25mm) what is less on [f]= 55,5 mm. The calculation attached.

5. Regarding cross beams (diaphragms)

The construction of the spans corresponds to the requirements given in the SNIP 2.05.03. – 84. But there is no girder, slab and diaphragm type superstructure in the SNIP. The diaphragms may be built according to the constructive requirements for increasing the span stiffness in transverse direction, but it isn't required in the case as all beams unified with monolith slabs with the thickness 20cm and it makes the span in the space in the transverse and longitudinal directions adequately stiff. The span deflection don't exceed the allowable value, but regard the camber 145 mm, what compensate back beam deflection on the first stage of the construction works during the assembling (the separate work of the back beam and the slab), the deflection will occur only of the temporary load, which constitutes 18mm.

6. 1 m of the monolith beam volume over the crossbeam is sufficient and corresponds to the checklist design inv. No 856. The hitch drawings attached.

7. **The effective height H= 7m is accepted for bending part till pedestal.** (wall -beam). But **the wall- beam - the stiff structure** without deformation is accepted as the foundation of the upper **pole construction.**

8. **Bridge Pads cast in- situ on the left dowels on the prefabricated cross – beams.**

9. **Wing walls is given in the Bill of Quantity under the item 221**

Welding is allowed according to SNIP 2.05.03 – 84 items from 3.155 till 3.161

Gasan Su Chay Bridge

1. Model

The theoretical base of PK "Lira – Windows" is the method of the finite elements (MFE), realized in the position of moving: KX= P
After it, we find vector X, then the other components of the strain and stress distribution. The main benefit is that we get matrix K and vector P by summarizing of the applicable stiffness matrixes and load vector, abiding for separate finite elements.
Have been used the following type of the finite elements: universal extensional bar (column, piers, cross- beams, beams) and universal extensional grid square element of the cover (slab of the carriageway).
All piers restrained in the foundation by the following axis: X, Y, Z, UX, UY, and UZ.

All hitches of the finite elements are banded with each other and it is fixing out the continuity of the element sections.

2. Regarding cross- beams (diaphragms)

The construction of the spans corresponds to the requirements given in the SNIP 2.05.03. – 84. But there is no girder, slab and diaphragm type superstructure in the SNIP. The diaphragms may be built according to the construction requirements for increasing the span stiffness in transverse direction. The Project is applicable to the checklist Project inv. No 14899 for beams without diaphragms.

3. Bond of the pile - works carry through the dowel of the frameworks from piles during the cutting the upper part of the piles on the design reference mark.

4. Loads on bridge is accepted in accordance to SNIP 2.05.03 – 84

5. Protective coat and the other structure coats of the carriageway is accepted by the checklist of the span design inv. No 14899

6. Maximum deformations. The spans is accepted by the checklist design inv. No 22155, but the maximum beam deformation during the merging of the uncut system will be smaller than in checklist design and is in the frame of the norm.

7. The cracking resistance of the all structures are verified according to the requirements of the SNIP 2.05.03 – 84, item 3.95 table 39

8. There is no the maximum reinforcement percentage of the reinforced concrete structures in the SNIP 2.05.03 – 84. Usually the reinforcement percentage constitutes 3 %.

9. The wing walls is given in the Bill of Quantity under the item 221

10. Welding is allowed according to SNIP 2.05.03 – 84 items from 3.155 till 3.161

DOCUMENT 6a

INFORMATION ON THE SET ISSUES

SHEMKIR CAY BRIDGE

1. On the issue of beam fixing on cross-beams:
   - I agree with the designer's answer
2. On the issue of the model for the statistic calculations:
   - I have no objections to "Lira-Windows" program:
3. On the issue of beams reinforcement with r.b. diameter 32 including crack resistance:
   - The author refers to the standard design; I am satisfied with author's answer
4. On the issue of maximum deformation of span constructions:
   - I agree with the attached calculations
5. On the issue of cross-beams fixing (aperture):
   - The author refers to the standard design; I agree with the answer
6. On the issue of beam grouting dimension in the above crossbeams part:
   - The author refers to the standard design; I am satisfied with the answer
7. On the issue of piers planning depending on height:
   - I agree with the author's answer
8. On the issue of bearing blocks construction:
   - I agree with the answer
9. On the issue of BoQ for wing walls construction:
   - I agree with the answer
10. On the issue of reinforcement constructions welding:
    - The author refers to SNIP; I am satisfied with the answer.

02·09·2003

DOCUMENT

GASAN SU CAY BRIDGE

1. On the issue of the model for the statistic calculations:
   - I have no objections to "Lira-Windows" program
2. On the issue of crossbeams fixing (aperture):
   - The author refers to the standard design; no objections.
3. On the issue of connection grillage with piles:
   - I agree with the author's answer
4. On the issue of loading on bridge:
   - The author refers to SNIP 2.05.03-84; I am satisfied with the answer
5. On the issue of the protective layer and the other constructive layers of the carriageway:
   - The author refers to the standard design; I am satisfied with the answer
6. On the issue of construction checking for crack resistance:
   - The author refers to the calculations made in accordance with the requirements of SNIP 2.05.03-84, item 3.95, table 39; I am satisfied with the answer
7. On the issue of span constructions maximum deformations:
   - The author refers to the standard design inv. N 22155; I agree with the answer
8. On the issue of the reinforcement maximum percentage:
   - I agree with the author's arguments
9. On the issue of BoQ for wing walls construction:
   - I agree with the answer
10. On the issue of reinforcement construction welding:
    - The author refers to SNIP 2.05.03-84, item 3.155-3.161; I am satisfied with the answer.

Chief Expert: S. Safarov

02.09.2003