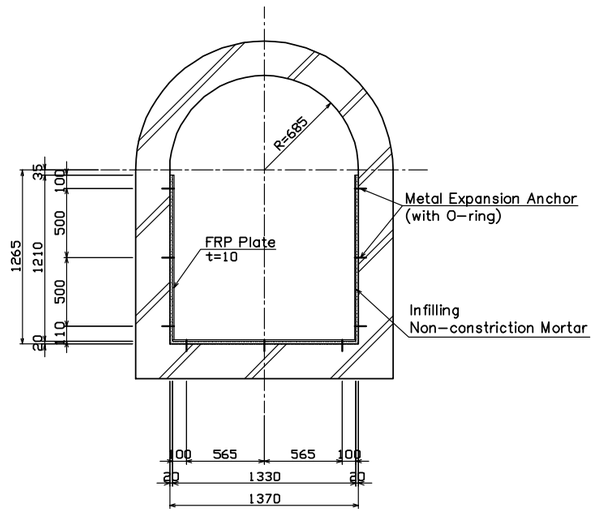
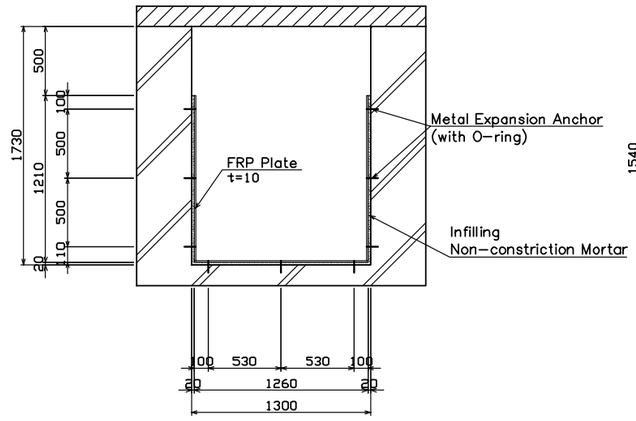
Standard Sections of Lining Works for Old Tunnel

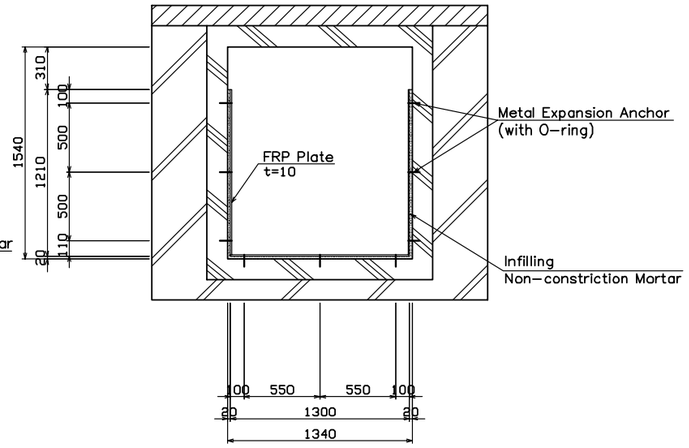
3 Faces Lining Work for Round Roof Section



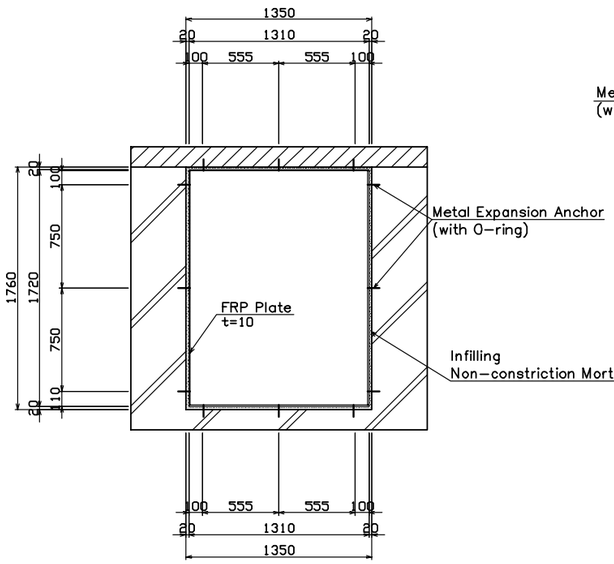
3 Faces Lining Work for Rectanglar Section



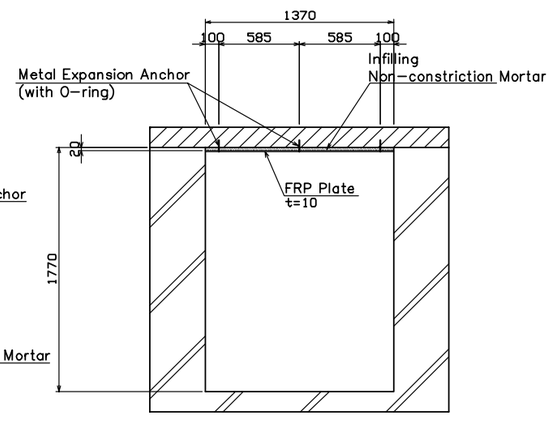
3 Faces Lining Work for Existing Reinforced Rectangular Section



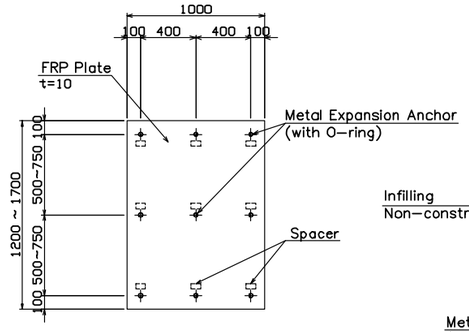
4 Faces Lining Work for Rectangular Section



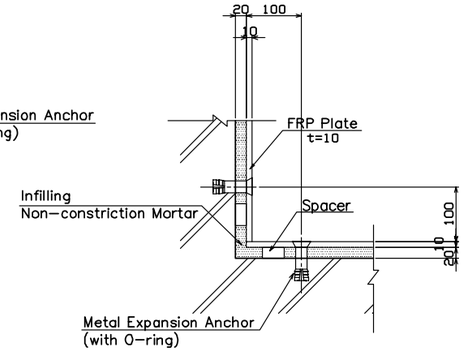
Crown Face Lining Work for Rectangular Section



Installation of Anchor Bolt



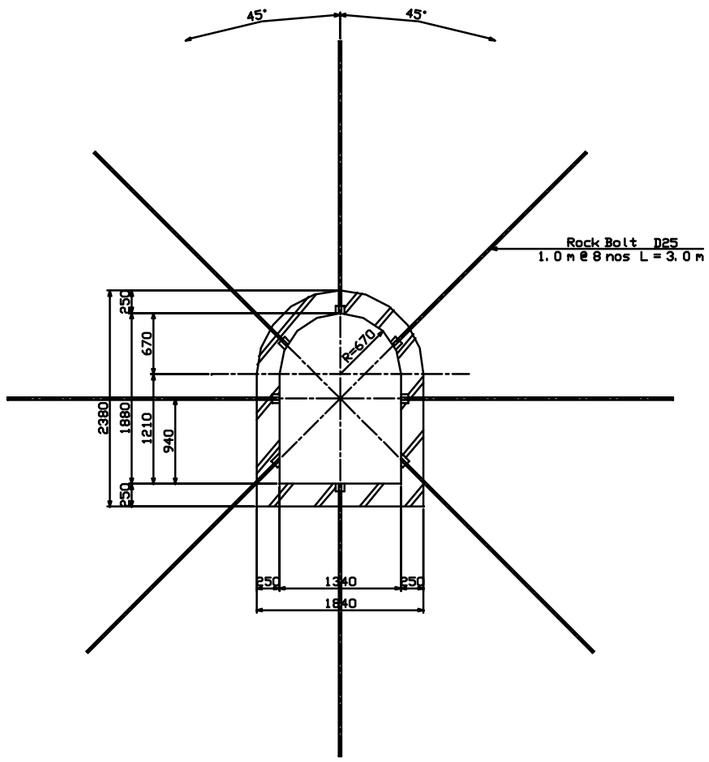
Details of FRP Plate Mount



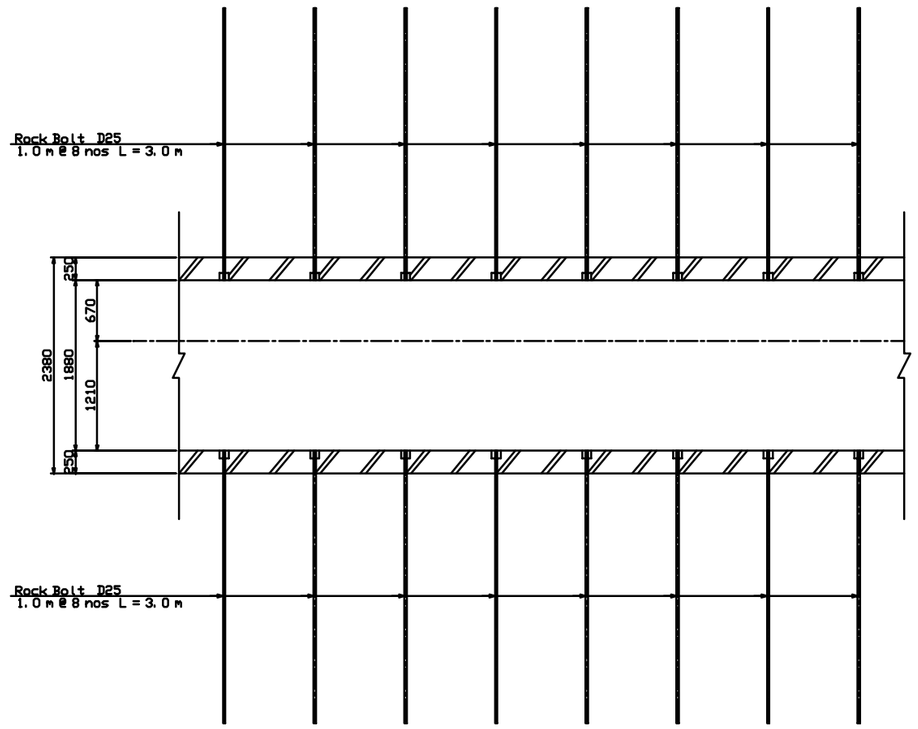
The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-3 Standard Section of Lining Works for Old Tunnel
Japan International Cooperation Agency	

Alignment of Rock Bolts (TD300.0~TD345.0m CL=45.0m)

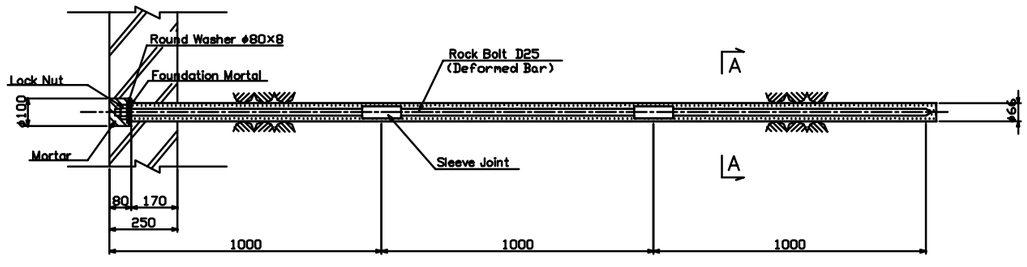
CROSS SECTION



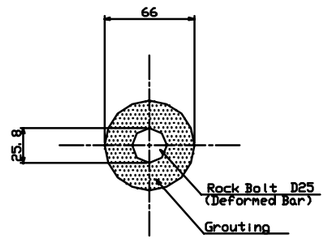
LONGITUDINAL SECTION



Detail of Rock Bolt



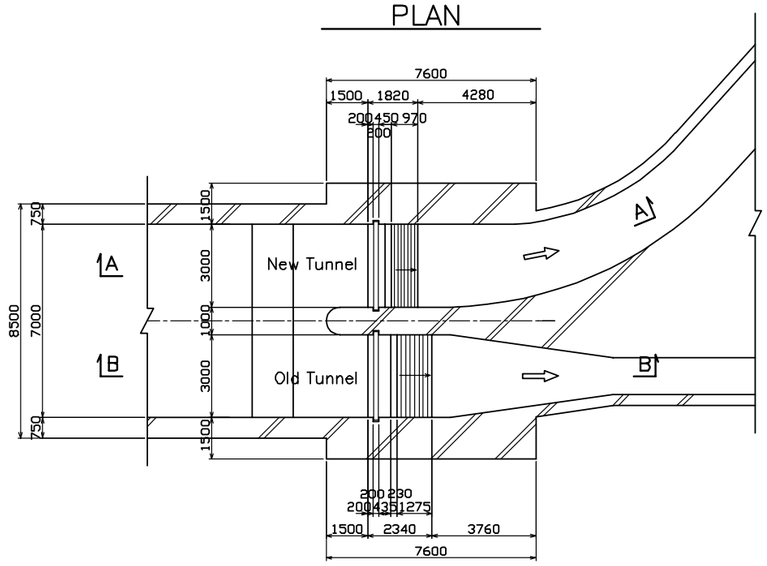
A–A SECTION



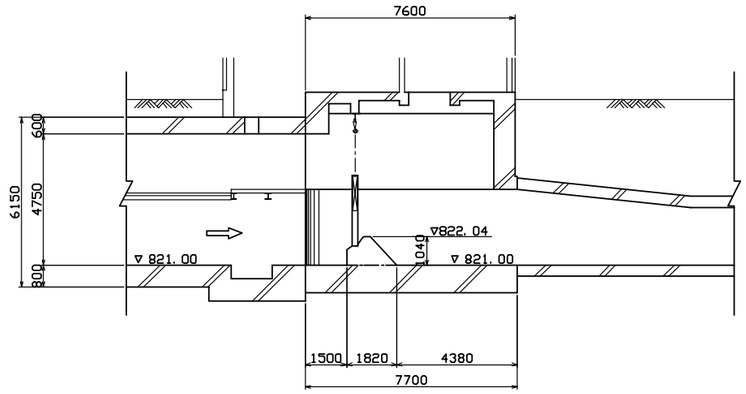
The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-4 Repair for TD300 – 345 Stretch of Old Tunnel, Alignment of Rock Bolts
Japan International Cooperation Agency	

Intake Gate at Figeh Spring

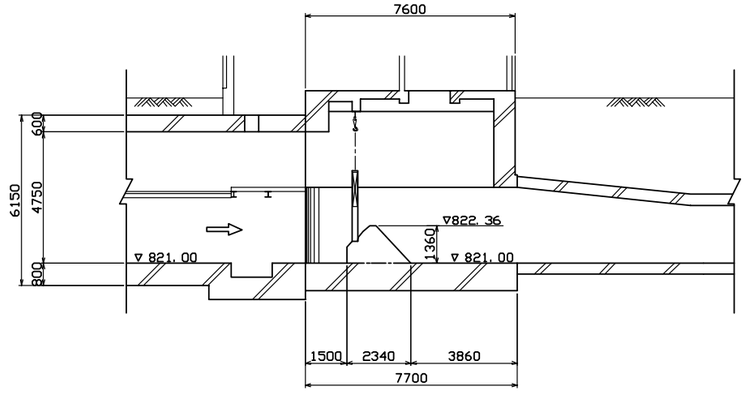
PLAN



A–A SECTION

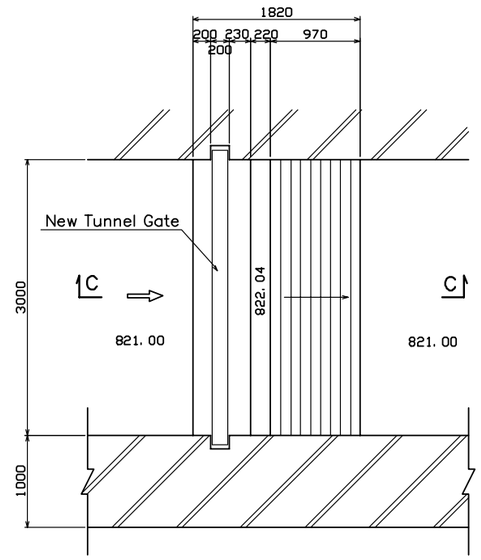


B–B SECTION

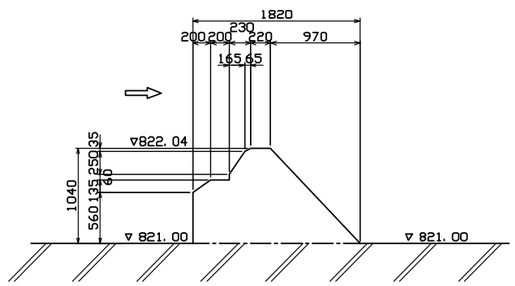


New Tunnel Gate DETAIL

PLAN

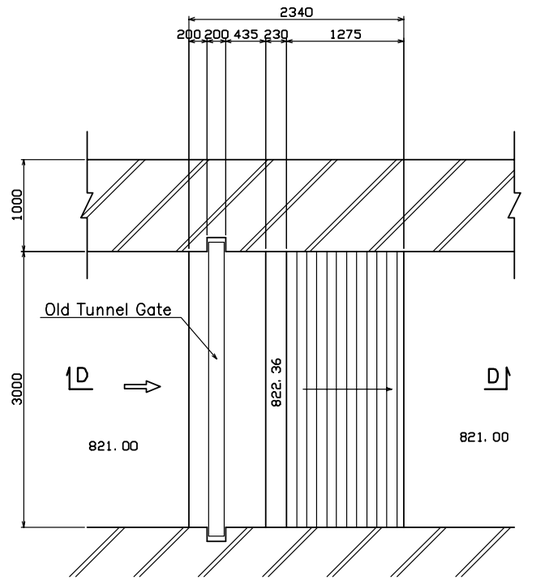


C–C SECTION

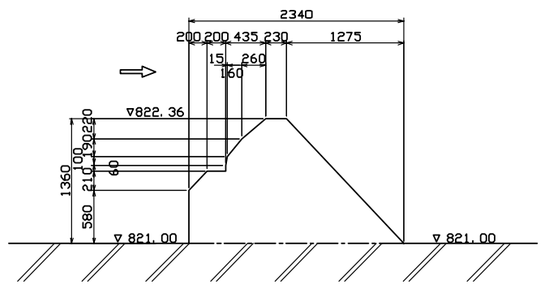


Old Tunnel Gate DETAIL

PLAN



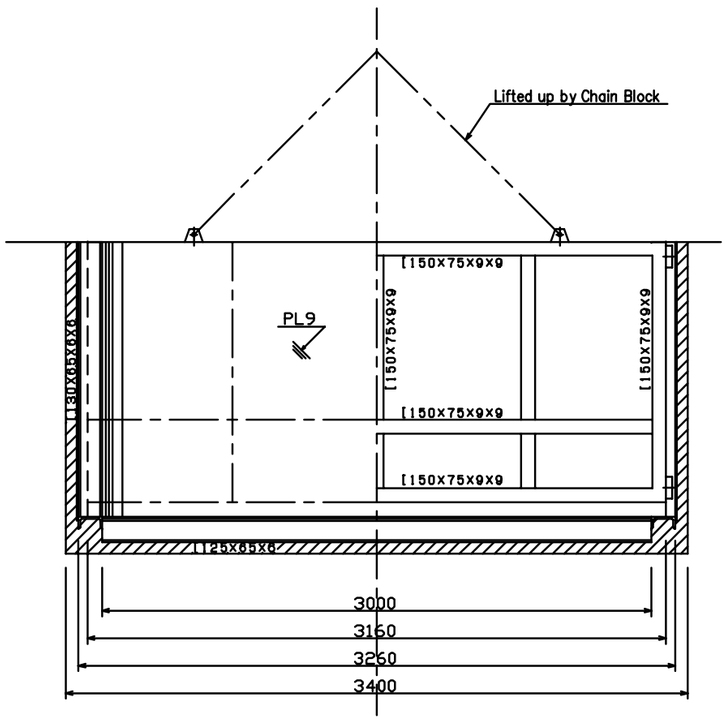
D–D SECTION



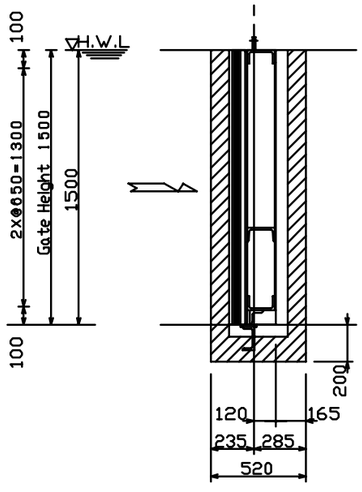
The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-5
Japan International Cooperation Agency	General Drawing of Intake Gate at Figeh Spring

Detailed Drawing of Intage Gate at Figeh Spring

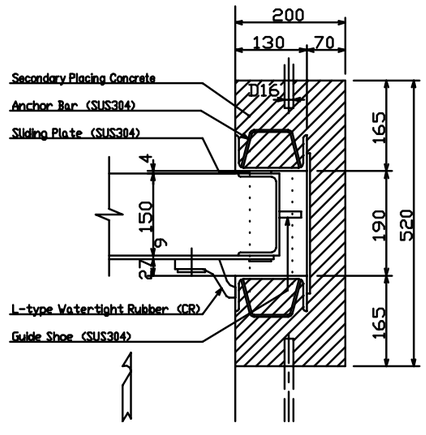
Elevation View



Cross Sectional View



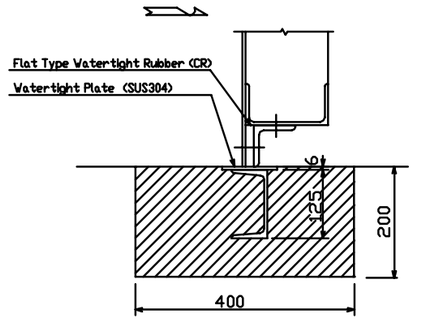
Detail of Watertight Device for Sliding Guide



Design Factor

Type	Stainless Flashboard
Material	SUS304
Width x Height	3.0m × 1.5m
Number of Unit	1 Gate
Design Water Depth	Front Side 1.5 m
	Rear Side 0.0 m
Watertight System	Watertight Rubber on 3-way of Front Side
Lifting Up System	Chain Block
Desgin Standard	Technical Standards of Watergate and Iron Pipe of Japan

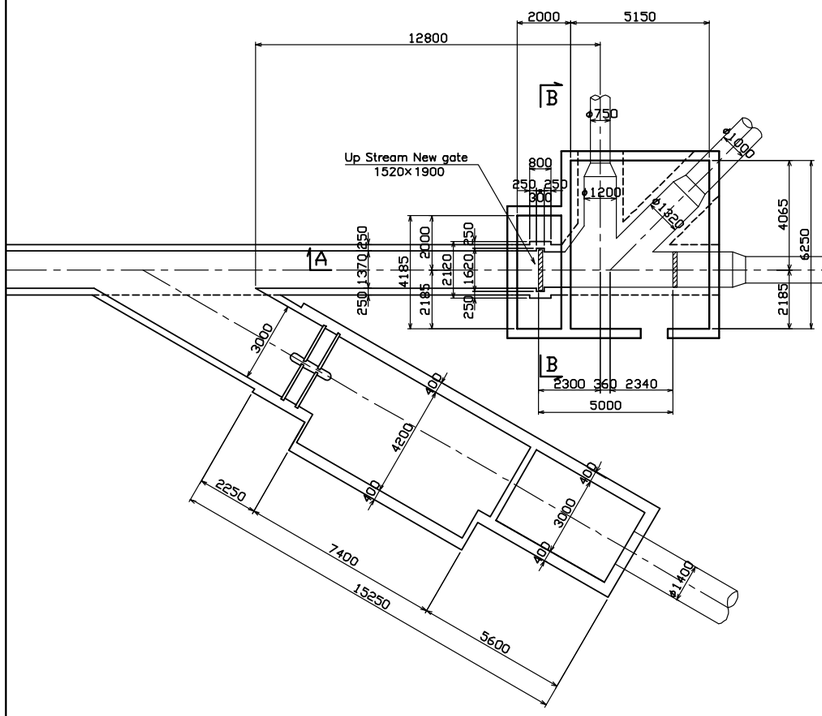
Detail of Watertight Device at Bottom of Gate



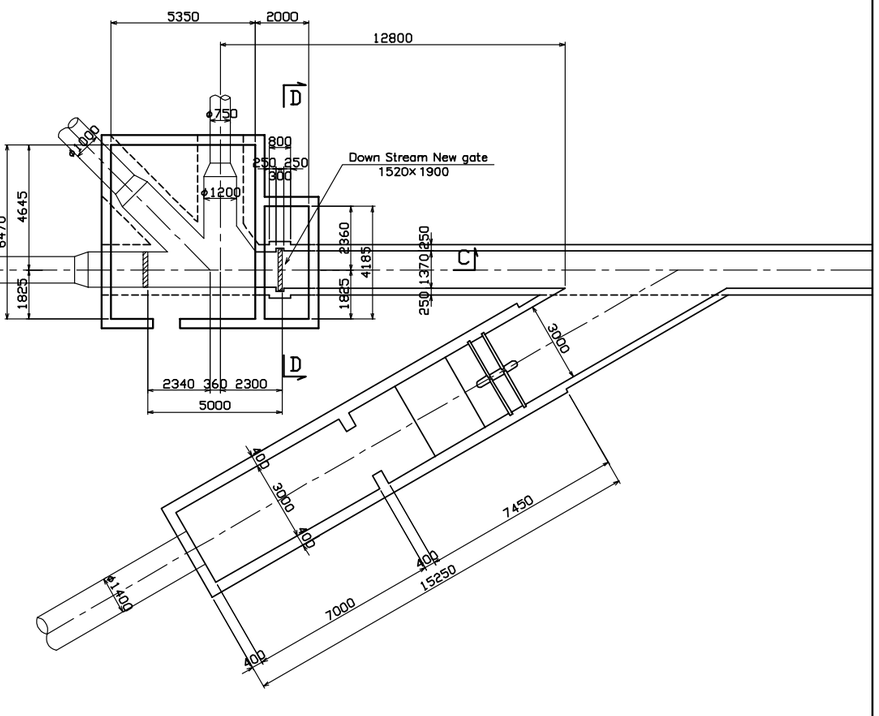
The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-6 Detailed Drawing of Intake Gate at Figeh Spring
Japan International Cooperation Agency	

General Drawing of Gate of Siphone of Old Tunnel

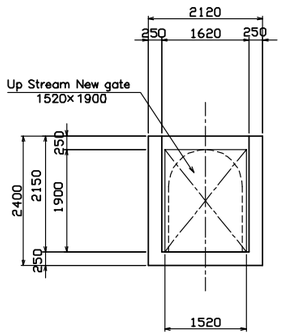
Up Stream Gate PLAN



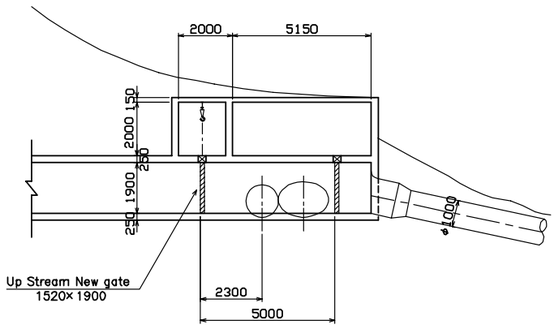
Down Stream Gate PLAN



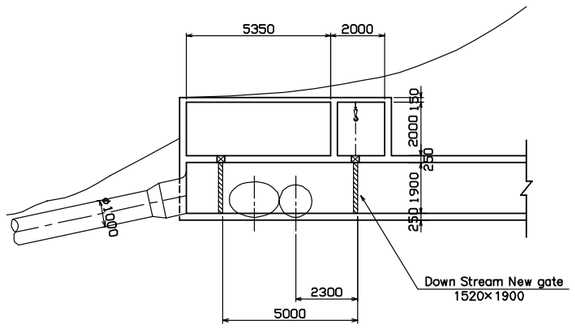
B–B SECTION



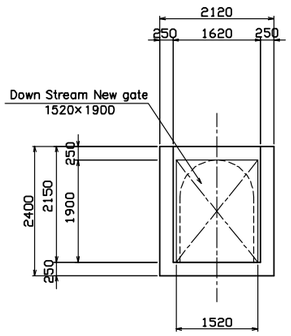
A–A SECTION



C–C SECTION



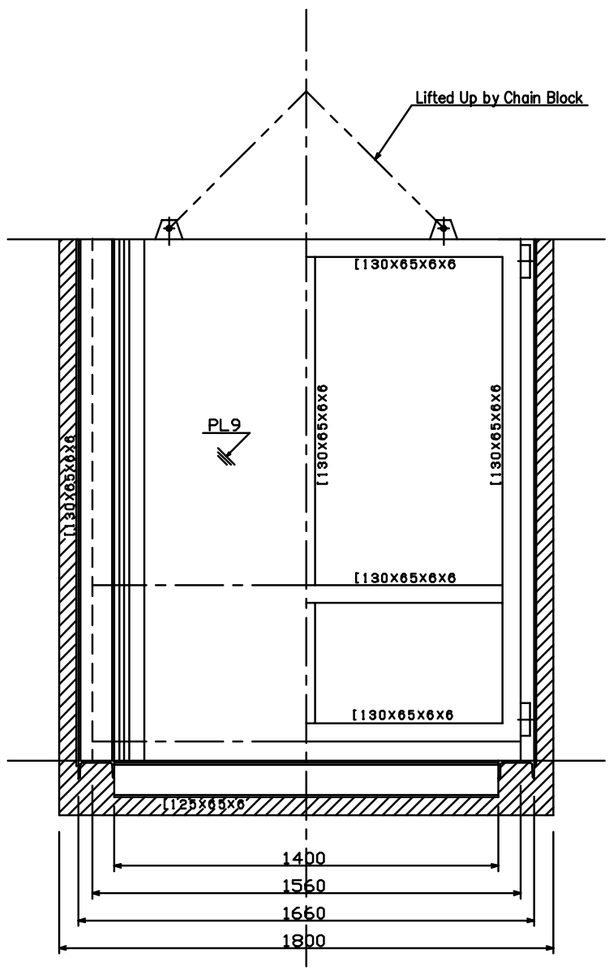
D–D SECTION



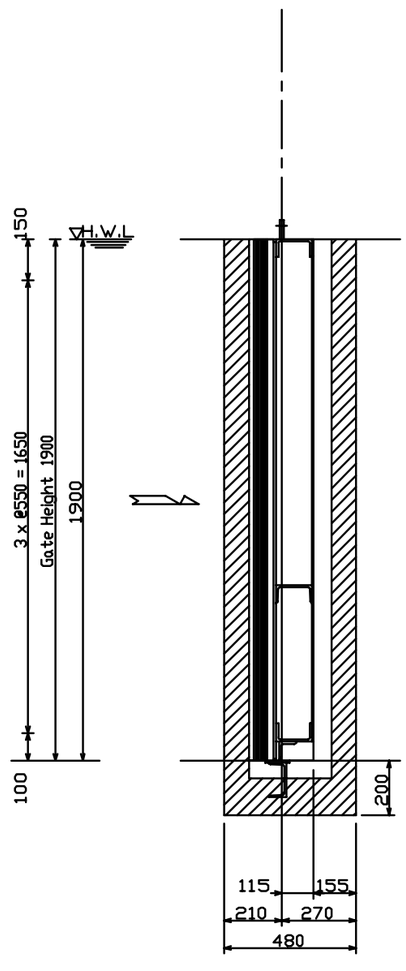
The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-7 General Drawing of Gate of Siphon of Old Tunnel
Japan International Cooperation Agency	

Detailed Drawing of Gate of Siphone of Old Tunnel

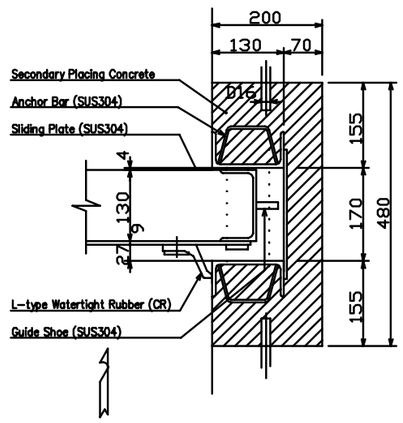
Elevation View



Cross Sectional View



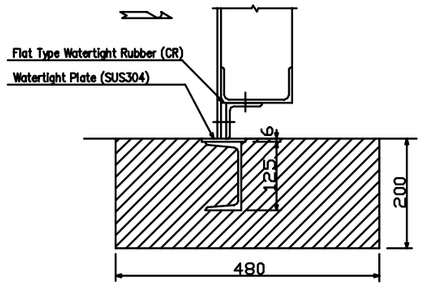
Detail of Watertight Device for Sliding Guide



Design Factor

Type	Stainless Flashboard
Material	SUS304
Width x Height	1.4m x 1.9m
Number of Unit	1 Gate
Design Water Depth	Front Side 1.9 m
	Rear Side 0.0 m
Watertight System	Watertight Rubber on 3-way of Front Side
Lifting Up System	Chain Block
Desgin Standard	Technical Standards of Watergate and Iron Pipe of Japan

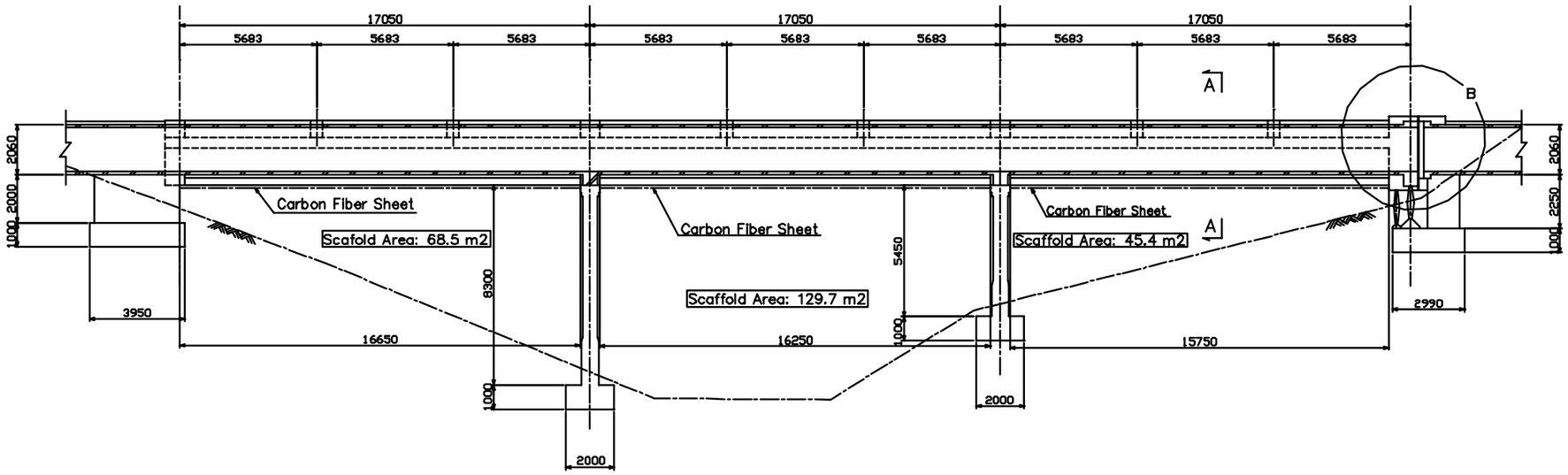
Detail of Watertight Device at Bottom of Gate



The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-8 Detailed Drawing of Gate of Siphon of Old Tunnel
Japan International Cooperation Agency	

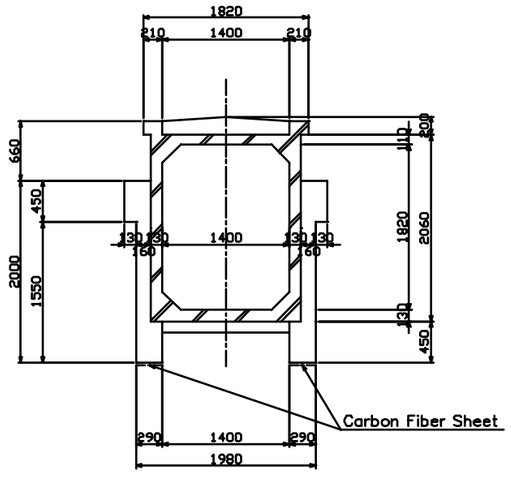
Detailed Drawing of Renovation of Aqueduct Bridge No.3 of Old Tunnel

LONGITUDINAL SECTION

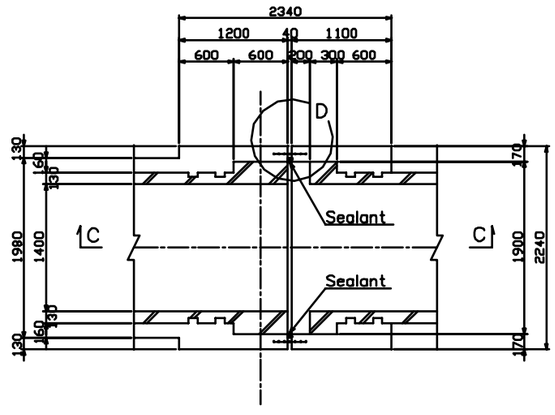


DETAIL " B "

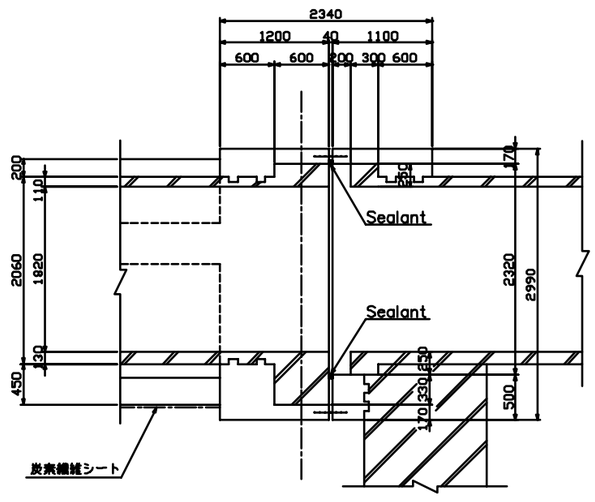
A–A SECTION



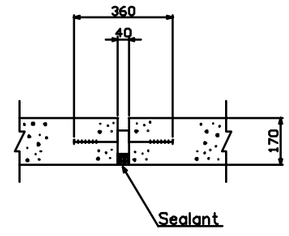
PLAN



C–C SECTION



DETAIL " D "

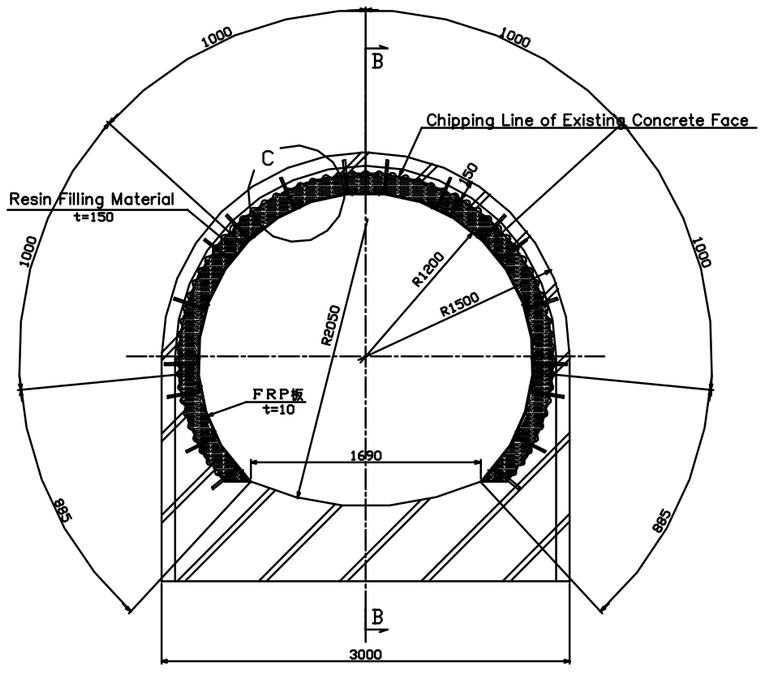


The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic Japan International Cooperation Agency	Figure 2-9 Detailed Drawing of Renovation of Aqueduct Bridge No.3 of Old Tunnel

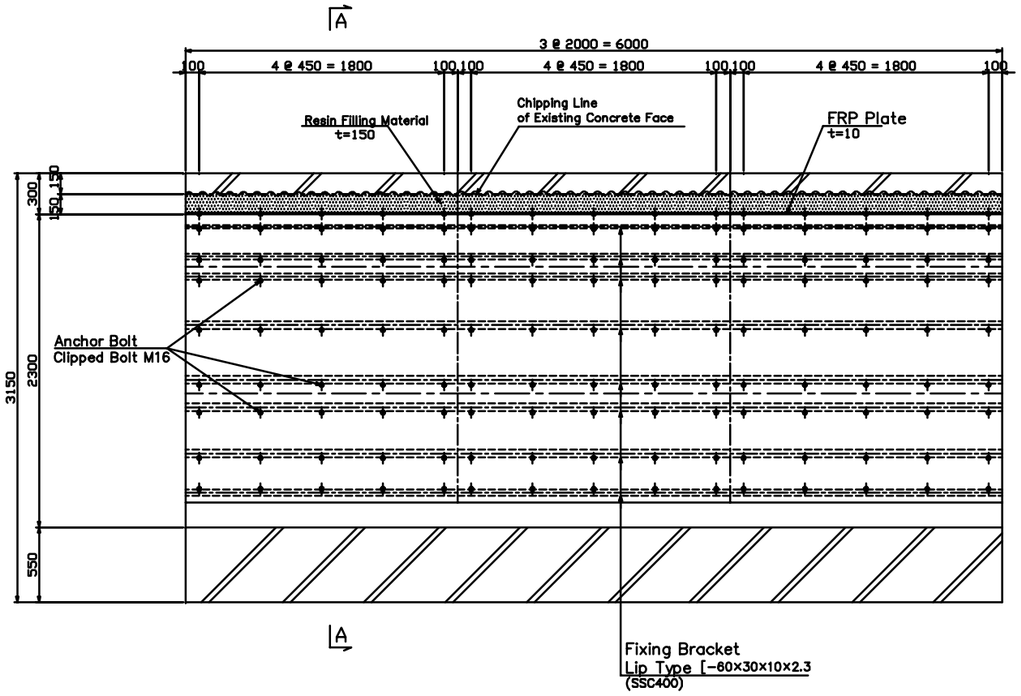
Detailed Drawing of Chemically Deteriorated Concrete Face of New Tunnel

(TD3166m~3172m L=6.0m)

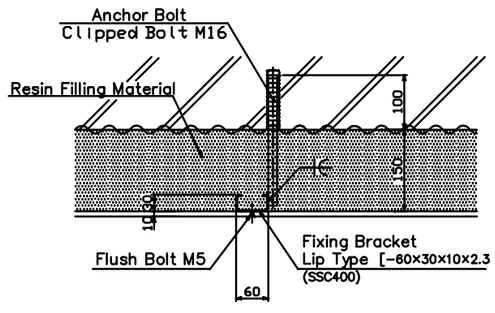
A–A SECTION



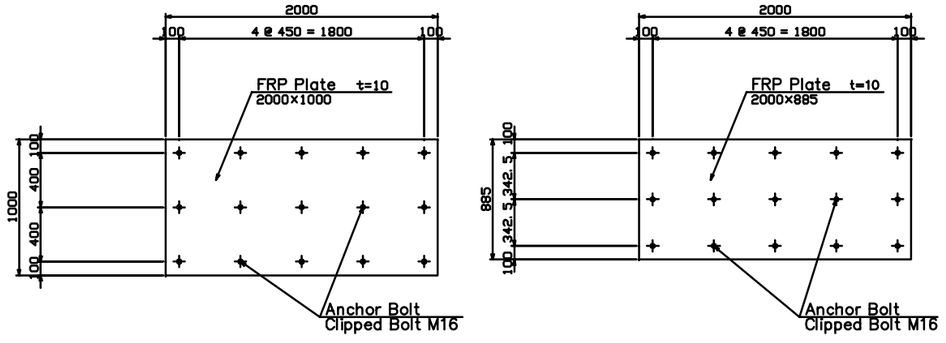
B–B SECTION



DETAIL " C "



Arrangement of Anchor Bolts



The Basic Design Study on the Project for Rehabilitation of the Water Transmission Tunnels in Damascus City in the Syrian Arab Republic	Figure 2-10 Detailed Drawing of Renovation of Deteriorated Concrete Face of TD3,166–3,172 Stretch of New Tunnel
Japan International Cooperation Agency	

Appendices

1. Member List of the Study Team

	Position/Tasks	Name	Affiliation
1	Leader	NAGASAWA Kazuhide	Resident Representative, Syria Office, JICA
2	Planning Management	MATSUMOTO Shigeyuki	Water and Sanitation Team Project Management Group I Grant Aid Management Department, JICA
3	Chief Consultant/ Tunnel Remedial Works 1	MARUYAMA Shigeru	Nippon Koei Co., Ltd.
4	Tunnel Remedial Works 2/ Geologist	CHIDA Masao	Nippon Koei Co., Ltd.
5	Concrete Diagnosis/ Non-Destructive Test	MATSUDA Sadanori	Nippon Koei Co., Ltd.
6	Remedial Material/ Method and Design	MAEDA Yoshiaki	Nippon Koei Co., Ltd.
7	Construction Plan/ Cost Estimate	MATSUMOTO Shinichi	Nippon Koei Co., Ltd.
8	Water Leakage/ Flow Discharge Investigation	Hisham Saad Mohamed Ali	Nippon Koei Co., Ltd.
9	Water Supply System/ Operation Plan	INABE Yoshiharu	Nippon Koei Co., Ltd.
10	Electromagnetic Radar Operation / Analysis	OKIYASU Yoshiyuki	Nippon Koei Co., Ltd.

2. Study Schedule

1) Field Survey

	Date (2004)	Week Day	Member's Activities	Stay	Survey Activities
1	13 Nov.	Sat.	Three members：Leaving Tokyo、Inabe: Arriv. at Dam.	On Board	Moving
2	14 Nov.	Sun.	Three members：Arriv. at Dam	Damascus	Office arrangement
3	15 Nov.	Mon.	S. Matumoto: Leaving Haneda, Arriv. at Dam.	Damascus	Reconnaissance to Figeh Spring
4	16 Nov.	Tue.		Damascus	Arrangement of data and equipment
5	17 Nov.	Wed.		Damascus	Visiting JICA office, SPC, MoHC. Discussions with DAWSSA.
6	18 Nov.	Thu.		Damascus	Discussions with DAWSSA.
7	19 Nov.	Fri.		Damascus	Data arrangement
8	20 Nov.	Sat.		Damascus	Field Investigation
9	21 Nov.	Sun.		Damascus	Signing MD, Investigation of the new tunnel.
10	22 Nov.	Mon.		Damascus	Investigation of the old tunnel
11	23 Nov.	Tue.	Maeda, Matumoto: Leaving Tokyo	Damascus	Investigation of the old tunnel
12	24 Nov.	Wed.	Maeda, Matumoto: Arriv. at Dam	Damascus	Investigation of the Wali reservoir
13	25 Nov.	Thu.		Damascus	Investigation of the old tunnel
14	26 Nov.	Fri.		Damascus	Data arrangement
15	27 Nov.	Sat.		Damascus	Internal meeting, Ground investigation
16	28 Nov.	Sun.	M. Ali, Matumoto: Leaving Tokyo	Damascus	Investigation of the old & new tunnel
17	29 Nov.	Mon.	M. Ali, Matumoto: Arriv. at Dam	Damascus	Investigation of the new tunnel
18	30 Nov.	Tue.		Damascus	Discussion with Lahmeyer. Investigation of the new tunnel
19	01 Dec.	Wed.		Damascus	Investigation of the Wali reservoir
20	02 Dec.	Thu.		Damascus	Field Investigation
21	03 Dec.	Fri.		Damascus	Data arrangement
22	04 Dec.	Sat.		Damascus	Internal Meeting
23	05 Dec.	Sun.	Chida: Completed assignment, Matuda: Back to Japan	Damascus	Progress report to JICA office
24	06 Dec.	Mon.		Damascus	Field Investigation
25	07 Dec.	Tue.		Damascus	Discharge measurement in new tunnel
26	08 Dec.	Wed.		Damascus	Discharge measurement in old tunnel
27	09 Dec.	Thu.	Matuda: Arriv. at Dam.	Damascus	Discharge measurement in old tunnel
28	10 Dec.	Fri.		Damascus	Data arrangement
29	11 Dec.	Sat.		Damascus	Internal meeting, Discharge measurement in old tunnel
30	12 Dec.	Sun.		Damascus	Field Investigation
31	13 Dec.	Mon.		Damascus	Field Investigation
32	14 Dec.	Tue.	Matumoto: Back to Japan	Damascus	Discussions on maintenance with DAWSSA
33	15 Dec.	Wed.		Damascus	Discharge measurement in old tunnel
34	16 Dec.	Thu.		Damascus	Field Investigation
35	17 Dec.	Fri.		Damascus	Data arrangement
36	18 Dec.	Sat.	Matumoto: Arriv. at Dam.	Damascus	Internal meeting
37	19 Dec.	Sun.		Damascus	Progress report to JICA office
38	20 Dec.	Mon.		Damascus	Field Investigation
39	21 Dec.	Tue.		Damascus	Field Investigation
40	22 Dec.	Wed.		Damascus	Field Investigation
41	23 Dec.	Thu.		Damascus	Report to JICA and embassy
42	24 Dec.	Fri.		Damascus	Data arrangement
43	25 Dec.	Sat.		Damascus	Drafting report
44	26 Dec.	Sun.	Five members leaving Dam.	On board	
45	27 Dec.	Mon.	Five members arriving Tokyo		

2) Explanation of Draft Report at Site

	Date (2005)	Week Day	Member's Activities	Stay	Survey Activities
1	10 Mar.	Thu.	Maruyama/Matsuda : Leaving Tokyo	On Board	
2	11 Mar.	Fri.	Two members : Arriv. at Dam	Damascus	
3	12 Mar.	Sat.		Damascus	Pre-discussion with DAWSSA, Visit to Figeh
4	13 Mar.	Sun.		Damascus	Visit to SPC, MoHC, Embassy, Discussion with DAWSSA
5	14 Mar.	Mon.		Damascus	Discussion with DAWSSA
6	15 Mar.	Tue.		Damascus	Discussion with DAWSSA
7	16 Mar.	Wed.		Damascus	Discussion with DAWSSA
8	17 Mar.	Thu.	Two members leaving Dam.	On Board	Signing MD, Visit to Embassy
9	18 Mar.	Fri.	Two members arriving Tokyo		

3. List of Parties Concerned in Syria

State Planning Commission (SPC)

Mr. Bassam al-Sibai,	Deputy Head of State Planning Commission

Ministry of Housing and Construction (MoHC)

Dr. Kamal Al Sheikla,	Vice Minister

Damascus City Water Supply and Sewerage Authority (DAWSSA)

Eng. Mwafak Khallouf,	General Director
Eng. Khaled al-Shalak,	Deputy General Director, Director of Studies and Designs
Eng. Nabel Abu Trab,	Head of Study Section, Studies and Designs Dept.
Eng. Sawsan Al Magribi,	Head of Structural Section, Studies and Designs Dept. (Civil Engineer)
Eng. Mayssa Al Akras,	Head of Topographical Section, Studies and Designs Dept. (Civil Engineer)
Eng. Youssef Bahssas	Execution Works related to Maintenance, Maintenance and Vehicle Dept. (Civil Engineer)
Eng. Monzer Amin	Deputy Head of Figeh and Barada Sites, Maintenance and Vehicle Dept. (Mechanical Engineer)
Eng. Anas Darwish	Studies and Designs Dept. (Civil Engineer)

Japanese Embassy in Syria

Takeshi Okuda	Second Secretary, Economic Cooperation

JICA Syria Office

Kazuhide Nagasawa	Resident Representative
Shigeru Otake	Deputy Resident Representative
Reiko Funaba	Assistant Resident Representative
Mr. Sakher Mrishih	Program Officer, Water Resources & Agriculture Sectors

4. Minutes of Discussions

4.1 Application for Grant Aid (July 2003)

SYRIAN ARAB REPUBLIC

DAMASCUS CITY WATER SUPPLY AND SEWERAGE AUTHORITY

Application for Grant Aid

To the Government of Japan

REHABILITATION PROJECT

OF

WATER TRANSMISSION TUNNELS

OF

DAMASCUS CITY

JULY 2003

APPLICATION FORM FOR JAPAN'S GRANT AID GENERAL AND FISHERIES

1. DATE OF ENTRY : July 2003

2. APPLICANT : The Government of The Syrian Arab Republic

3. PROJECT TITLE : Rehabilitation Project of Water Transmission Tunnels in Damascus City

4. SECTOR : Water Supply

5. PROJECT TYPE : Facilities Construction

6. TARGET SITE : (province/country name): Damascus/Syria
(municipality/town/village name): Damascus city
(from the metropolis): about 30 minutes ride

A map indicating the site location of New and Old Tunnels is attached as Appendix- 1.

7. REQUESTED AMOUNT : Japanese Yen 1,492 Million (US$ 12,431,000)

8. DESIRED FISCAL YEAR OF IMPLEMENTATION:

Basic Design	:	FY 2004
Detailed Design	:	FY 2004
Implementation	:	FY 2005 – FY 2007 (3 years)

Please refer to the attached Appendix-2.

9. IMPLEMENTING AGENCY :

Ministry	:	The Ministry of Housing and Utilities (MOHU)
Implementing Agency	:	Damascus City Water Supply and Sewerage Authority
Person In Charge	:	Eng. Khaled Shalak (Deputy General Director)
Address	:	P.O. Box 2972, Damascus, Syria
Telephone No.	:	963-11-2392290 ~ 2214534

10. OUTLINES OF THE IMPLEMENTING AGENCY

(1) Outline

Damascus City Water Supply and Sewerage Authority (DAWSSA) is the implementation agency for the proposed project. DAWSSA will represent as a technical counterpart organization responsible for the project. Please refer to the attached Appendix-3, which shows the organization chart of DAWSSA.

Ministry of Housing and Utilities (MOHU) is the government organization which manages DAWSSA. Please refer to the attached Appendix-4, which shows the organization chart of MOHU.

(2) Authorities and Duty

DAWSSA is responsible for the supply of water to the Governorate of Damascus which includes 7 villages outside the Governorate jurisdiction along the Barada river valley. DAWSSA carries out the studies and engineering of water supply projects, and construction and operation & maintenance of water supply facilities.

(3) Personnel

DAWSSA has 1,553 employees including temporary and permanent staff. The responsible directories are as follows:

Production directory	:	235 employees
Distribution directory	:	225 employees
Maintenance & Vehicles directory	:	145 employees
Studies & Design directory	:	135 employees
Financial Affairs directory	:	106 employees
Planning & Statistics directory	:	8 employees
Construction & Supervision directory	:	38 employees

Please see Appendix-3.

(4) Budget (Revenue and Expenditure)

Budgets of DAWSSA for the fiscal years 1998-2002 are presented below:

(Unit: Million SP)

	FY 1998	FY1999	FY 2000	FY2001	FY 2002
Revenue	497	489	443	516	529
Expenditure*	825	1,008	1,159	1,282	1,337
Balance	-328	-519	-716	-766	-808

(Remark) Exchange rate applied: US$1.00=Syrian Pound 51.50=JP¥120 as of June 2003.

Note*) Expenditure including project investment is subsidized by Syrian government.

(5) Organization chart

Please refer to the attached Appendix-3 Organization Chart of DAWSSA and Appendix-4 Organization Chart of the MOHU.

11. BACKGROUND OF THE REQUEST

(1) Current situation of the Sector

Figeh Spring, which is located in the Anti-Lebanon mountains about 15 km northwest of Damascus City, is used as the main water source for Damascus City. The water from Figeh Spring is conveyed to Wali and Western reservoirs at the east end of mountains through the two water transmission tunnels and is distributed to the consumers in Damascus City. In addition to the Figeh Spring water, the groundwater in Barada Spring and water from other small springs are supplementary utilized and conveyed to Damascus through Figeh and the same tunnel routes. There is no other water supply system in the area, therefore two tunnels are the lifelines of Damascus City at present. The two water transmission tunnel routes from Figeh to Wali and Western reservoirs are shown in **Appendix-1**.

Damascus City is located at about 60 km south east of the 1759 historical earthquake center in the Bekka Valley of Yammouneh Fault (**Appendix-5**).

The old tunnel was constructed between 1925-1926 and 1928-1929. It is horseshoe shaped tunnel and its length is about 16 km with 1,360 mm and 1,880 mm width at most of the sections. Flow capacity of the old tunnel is 3.5m^3/s. The old tunnel also supplies water to the suburb towns of Damascus city. The new tunnel was constructed in 1980. It is round shaped one about 15 km long, with an inside diameter of 2,550 mm. Tunnel transmission capacity is 11.3m^3/s for the new tunnel. Therefore, a total combined capacity of the both tunnels is 14.8m^3/s.

Because the transmission tunnels were deteriorated, DAWSSA carried out surveys and

rehabilitation works for the both tunnels in order to secure enough flow capacity as the lifeline of Damascus City. The old tunnel was inspected in 1968 and 1980 by French consultants. The survey found that water leakage occurred through the open cracks and porous concrete, and the rehabilitation works were conducted based on the survey results. Despite of the implementation of these rehabilitation works, oxidized reinforcing bars were still exposed on the ceiling of the tunnel in many places. This was found by the survey conducted in September 1999. Many residual chlorine tests were carried out on different dates, the last two of which were in March 2002 and April and May 2003. The test results showed that the residual chlorine quantity dropped significantly due to inflow by water seepage.

The new tunnel was inspected on December 27, 1997. The survey found that water leakage from outside into the tunnel occurred at several sections. The latest survey was conducted on May 27, 2003 and the site conditions were the same as the previous situation. No rehabilitation works have started yet for the new tunnel. In addition to the tunnels inspection, the survey for the reservoirs was conducted by DAWSSA on April 28, 1998. Many hair cracks were found at the Reservoir 4 in the new Wali reservoir by the survey. Those cracks were rehabilitated urgently by polyurethane liquid on November 14, 1999, and they are functioning effectively at present.

(2) Present problem to be solved in the Sector

Water leakage and reinforcing bar rust still occur in many sections for the both tunnels even after execution of the rehabilitation works. The old tunnel has constructed more than 70 years ago so that concrete material characteristics have already been deteriorated in some sections. Present problems occurred in the both tunnels are as follows:

1) Old tunnel

a) Reinforcing bar corrosion and concrete surface exfoliation were found in many parts of the rehabilitated sections. Carbon dioxide enters from cracks and it neutralizes structure concrete, then reinforcing bar was corroded and expanded. As the result, concrete strength was deteriorated and surface concrete was peeled.

b) Concrete surface softens and falls easily by hummer hitting inspection. It is supposed that surface concrete strength have been deteriorated severely.

c) Though the heaviest damaged section was rehabilitated by steel pipe lining method, the pipes had been corroded and concrete around the pipes were peeled off.

d) Corrosion protection coating was peeled off together with the surface concrete so that its function got worse at present.

e) Rust on the reinforcing bars and steel pipes affect water quality inside the tunnels.

f) Weathered rock layers exist on the tunnel route, and this area can make void between the surrounding rock and the concrete lining due to erosion by water seepage. Consequently, earth pressure increment and land settlement occur easily on account of surrounding rock erosion. Damaged area is in accordance with the geologically weathered area.

g) Crack happens at upstream of the tunnel and seepage water emerges there mostly. When DAWSSA noticed such phenomena, they requested adding some quantity of the disinfectant in order to compensate diluted chlorine.

2) New tunnel

a) Water leakage and seepage water appear from the construction joint mainly. This damaged area exists in the weathered rock layer mostly, which formulates a water path in the layer, and groundwater affect the tunnel performance.

b) Iron content in the surrounding rock exudes on the concrete surface. In this case a crack depth of the concrete lining has reached at its outside surface, then leakage and seepage water will cause to make void between the concrete and the surrounding rock. Once void creates, the tunnel cannot have enough stability for the external loads, such as earthquake and vehicular loads. Consequently, some deformation of concrete probably occurs.

(3) Necessity and importance of improvement in Sector which lead to the formulation of the Project

In the JICA study report prepared in 1996, Unaccounted for Water (UFW) rate was estimated to be 64% of total water supply volume and a target figure of UFW was set to be 25% for the year 2015. As the counter measure for reducing such a high rate of UFW, execution of the renewal program for the existing facilities was strongly recommended in the report. As the first priority project, distribution pipe replacement project was conducted through Japan's Grant Aid from 1998 to 2003 and UFW rate in the distribution system shall be reduced after the project. In order to accomplish UFW rate to the target level, leakage prevention methods for the transmission tunnels are requisite as the succeeding stage.

Water leakage affects flow rate, and corrosion and grass roots inside the tunnel makes water quality worse. This problem occurs for the deteriorated sections of the old tunnel and weathered rock section of the new tunnel remarkably in comparison with the other sections. The two tunnels are the only water transmission system for Damascus City so

that stable and safe water supply system shall be required as the lifeline of beneficial peoples. Therefore, it is necessary to reinforce these sections of the both tunnels for the sustainable water supply for Damascus city. It is quite difficult to improve the existing facilities by applying the temporary rehabilitation methods. Therefore, permanent rehabilitation works are urgently required to protect the concrete surface and the surrounding bedrock, and improve the tunnel flow capacity as well as water quality fully.

(4) Relation between the Sector and the Project

Following methods are considered to conduct the tunnels rehabilitation works:

1) Old tunnel

Cracks and damaged spots occur mainly existing rehabilitation sections and the section under the road close to Wali reservoir. It is effective to rehabilitate these sections properly to secure enough flow capacity to Damascus city. Existing concrete lining has been already cracked; grass roots emerge from cracks. Therefore, the Project applies the method to cover the existing concrete surface by new material. After installation of the material for the surface concrete, the tunnels can improve its stability for loads and grass roots cannot occur in the tunnels.

2) New tunnel

Damaged section appears close to Figeh spring in the new tunnel remarkably. Leakage and seepage water deteriorate concrete performance of the tunnel and this mainly occurs from construction joints. Inflow rate of the new tunnel is three (3) times larger than the inflow of the old tunnel. Deterioration in quality of the new tunnel invites quite seriously damage for the flow capacity of the new tunnel. In case that damaged section expands, large scaled rehabilitation works shall be required. Therefore, it is economical and effective to rehabilitate urgently in view of tunnel's life. The Project applies construction joints rehabilitation method to stabilize the tunnel performance and flow capacity.

(5) Reasons why Japan's Grant Aid is requested for this particular Project

Japan is well known for advanced knowledge and technology in the field of the pipeline rehabilitation project. Also, "The Implementation Review Study on The Project for Rehabilitation of Water Distribution Pipelines in Damascus City" was implemented by JICA from 1998 to 2002; DAWSSA understood that Japan's Grant Aid was very effective for the improvement of water supply system in Damascus city. Accordingly, it would be most suitable to apply to the Government of Japan for future financial and technical assistances with the Project.

12. RELATION WITH THE GOVERNMENT'S DEVELOPMENT PLAN AND OTHER FACTORS

(1) Relation with the government's national development plan

Syrian government has the 9th Five Year Development Plan (2000-2005) on water supply field for Damascus city and the Project is located as the high priority one in order to increase the water supply volume.

(2) The position occupied by the requested project/sector in the above mentioned plan

Expansion and rehabilitation plan

13. OBJECTIVES (ITEMIZE AS CONCRETELY AS POSSIBLE)

(1) Short term objectives

The short term objectives of the project are to utilize the current water resource effectively by rehabilitating the damaged section of the both transmission tunnels. Rehabilitation works improve flow capacity resulting from leakage and water quality resulting from infiltration of water.

(2) Medium and long term objectives

The medium and long term objectives of the project are

1) To secure safe and stable water supply for the city of Damascus on maintaining the both transmission tunnels flow function permanently, and
2) To formulate the expansion of the structure's life through the rehabilitation works.

14. OUTLINE OF THE PROJECT AND REQUEST (ITEMIZE AS CONCRETELY AS POSSIBLE

(1) Outline of requested project

Rehabilitation project of the water transmission tunnels consists of the following works;

1) Basic design

DAWSSA has already possessed the records on the damaged sections, such as cracks inside the tunnels, which was inspected before. The preliminary survey is conducted to verify

between the inspection records and the final outputs (e.g. as-built drawings and geological survey results) prior to the site survey. This work will analyze and clarify the cause of the damaged section and the rehabilitation methods.

The site survey is conducted by applying to non-destructive inspection method which is able to measure in succession and short period for the entire tunnel. Following points are investigated by the site survey: 1) concrete strength on the tunnel surface and 2) the distance between the concrete lining and the surrounding bedrock. The collected data is used to make for the comprehensive rehabilitation plan upon considering tunnel stability.

The basic design will be prepared based on all the information collected in this stage.

2) The old tunnel rehabilitation plan

The Project will plan to rehabilitate following six (6) sections (Refer to Appendix-6). Total length of the rehabilitation sections is 3,382m out of 16,200m. Because concrete strength of the damaged sections has already been deteriorated inclusively, new pipe material is settled inside the tunnel to cover the damaged surface. Material is considered the one which has the advantages in no permeability, high strength and high durability. It is supposed that void still exists in the old horseshoe shaped section with 570m length; therefore, grout is poured into void between the concrete surface and the surrounding bedrock to stabilize the tunnel structure. Corroded gate valves and related equipment also shall be replaced.

Old tunnel sections to be rehabilitated by the Project

No.	Section	Length
1	1,380~ 1,670 m	290 m
2	2,400~ 3,060 m	660 m
3	9,563~10,780 m	1,217 m
4	12,325~12,745 m (Siphon)	420 m
5	13,630~13,872 m	242 m
6	15,700~16,212 m	512 m

*Note : Beginning point starts from Figeh Spring.

3) The new tunnel rehabilitation plan

The rehabilitation works will be carried out for the section between 3,500m and 4,500m from the Figeh Spring and total length is 1,000m out of 15,000m (Appendix-7). Water leakage and seepage water mainly occur from construction joints. Therefore, the rehabilitation work of the new tunnel is to prevent water from the construction joints. Protection material is applied to function certainly under wet conditions. The sections, where tunnel boring machine is not used for the construction, may have void between

concrete surface and surrounding rock surface. Therefore, grout is poured to fill the void and stabilize the tunnel strength. Further, non-return drain valve is provided to flow out seepage water behind the tunnel.

New tunnel sections to be rehabilitated by the Project

No.	Section	Length
1	16~ 806 m	790 m
2	2,541~3,301 m	760 m
3	3,500~4,500 m	1000 m
4	4,783~5,723 m	940 m
5	9,546~10,746 m	1,200 m
Total		4,690 m

*Note : Beginning point starts from Figeh Spring.

(2) **Location plan of each facility and/or equipment**

Please refer to the attached **Appendix-8.**

(3) **Cost estimate**

The total project cost is estimated at US$ 12,856,000 (JP¥ 1,543,000,000) as summarized below:

Rehabilitation works for the Old Tunnel Phase 1	US$ 4,157,000
Rehabilitation works for the Old Tunnel Phase 2	US$ 4,507,000
Rehabilitation works for the New Tunnel Phase 3	US$ 3,767,000
Total	US$12,431,000

(Remark) Exchange rate applied: US$1.00=JP¥120 as of June 2003.

(4) **Methods to maintain the facility and financial source**

No maintenance work is required after five (5) years of the project completion. After that periodical site inspection will be required in every two (2) years.

(5) **Additional information**

a) **Existing facilities**

Please refer to the attached **Appendix-8.**

The degree of damage observed in May 2003 is shown in **Appendix-9.**

b) **List of existing equipment**

c) **Other information, statistics and data regarding site conditions, etc.**

Please refer to the final report of the Study done by JICA.

(6) **Project site preparation (including expropriation)**

Land : -
Name of the land owner : -
Area : -

Temporary work site will be required during the construction stage, and the required area is not so large and temporary purpose only.

- **Current situations of the project site, such as leveling, drainage, availability of power, water supply, telephone, etc.**

Power supply, water supply and telephone line are available near the site.

- **Security situation**

No problems

(7) **Related grant aid cooperation in the past.**

FY : 1998 to 2000 (Stage I, II & III)
Title : The Project for rehabilitation of water distribution pipelines in Damascus city
Amount : Japanese ¥ 1,492 million
Target area : Wali & Malki, Old city, Presidential area & Nasr

Assessment on level of utilization of the project

(a.) Good
b. Passable
c. Bad
d. Not utilized

FY : 2002 to 2003 (Stage I & II)
Title : The Project for rehabilitation of water distribution pipelines in Damascus city (Phase II)
Amount : Japanese ¥ 1,129 million
Target area : Kafar Sousa & Bagdad & Berzeh & Midan, Mezze

Assessment on level of utilization of the project

(a.) Good
b. Passable
c. Bad
d. Not utilized

15. BENEFIT AND EFFECTS OF THE PROJECT.

(1) Area that will benefit from the project (specify the total area, if possible)

About 110.58 km^2 of service area in Damascus city

(2) Population that will benefit

Directly : About 1.51 million persons living in Damascus city

Indirectly : About 2.61 million persons living in DAWSSA's service area including rural area

(3) Expected social and economic effects

a) Present situation

According to the previous inspection records, both transmission tunnels have severe water leakage. As for the old tunnel, concrete material deterioration is progressed remarkably to compare with the new tunnel. The current situation interrupts to supply enough water in view of its quantity and quality and makes unstable water supply for Damascus city.

Several sections, which rehabilitation works are required, pass under the existing roads. Those sections receive heavier loads by vehicle than normal section so that structural damage on the tunnel is more serious. They have higher risk for the tunnel collapse especially while earthquake happens.

b) Expected effect of the project

The existing transmission tunnels are the only water supply system and are used as the lifeline of Damascus city people. The both transmission tunnels can increase its flow rate after the project implementation, and it will contribute the safe and stable water supply for Damascus city.

If the tunnels collapse, water cannot supply to Damascus city and social and economical damages are enormous. The Project mitigates the risk as the tunnels are reinforced by engineering methods, and establishes permanent water supply stability.

16. PUBLICITY

If the Project is implemented with Japan's grant aid, about 2,610,000 people in Damascus City will receive the benefit or positive effect of the Project.

17. RELATION WITH TECHNICAL COOPERATION, ETC.

(1) Feasibility study:

Already effected/being effected.

From month _____ year _____ to month _____ year _____

Conducted by :

Not yet effected.

(2) Technical cooperation

which of the following forms of assistance do you require?

a. Project - type technical cooperation
b. Long - term experts : _____ persons
c. Short - term experts : _____ persons
d. JOCV. : _____ persons
e. Acceptance of trainees : _____ persons
f. Not needed

when the technical cooperation is underway

Title : Water Supply Expert (District Meter Area System)

Period : from month 5 year 2003 to month 4 year 2005

a. Project - type technical cooperation :
b. Long - term experts : _____ persons
c. Short - term experts : _____ persons
d. JOCV (Senior Volunteer) : 1 persons
e. Acceptance of trainees : _____ persons

18. REQUEST TO OTHER DONORS FOR SAME PROJECT

No

19. PRIORITY

The rehabilitation of water transmission tunnel is the most urgent and important issue for DAWSSA in order to sustain the lifeline of Damascus city in the national capital. This Project has the highest priority among other projects.

20. AID BY THIRD COUNTRIES OR INTERNATIONAL ORGANIZATIONS IN THE SAME OR RELATED FIELDS.

No.

21. OTHER INFORMATION WITH SPECIAL REMARK (WHETHER OR NOT PRIVATIZATION POLICY IS EFFECTED. IF YES, INDICATE THE RELATIONSHIP WITH THE REQUESTED PROJECT)

No privatization is considered in this sector.