The waterways in South - Limburg

RIJKSWATERSTAAT

MAASTRICHT

THE WATERWAYS IN SOUTH-LIMBURG.

The hydraulic works in behalf of the waterways in South-Limburg are to be divided into two groups:

A. The canalisation of the Meuse near Maastricht.
B. The Juliana-canal.

The discharges of the Meuse at Maastricht vary from a maximum of 3000 m^3/sec., to a minimum of 20 m^3/sec. during dry summers.

A. The works at Maastricht.

The weir at Borgharen (completed in 1929) serves to make the Meuse navigable for barges with a loading capacity of 2000 metric tons and retains the upper pound of the Juliana-canal. The retaining level amounts to 44.00 m. + N.A.P. (Normal Amsterdam Datum).
The weir has three discharge openings, each 23.00 m wide and an opening of 30 m. width for navigation to pass. The discharge openings are equipped with single rolling vertical lift sluices, provided with adjustable valves. The navigable pass is provided with a single rolling vertical lift sluice.

The lock at St. Pieter. (completed in 1927) connects the canalized Meuse with the Liège-Maastricht canal (constructed from 1847 to 1850). This lock is adapted to barges up to 1000 metric tons. The canal Liège-Maastricht is only navigable for barges of 600 metric tons, just the same as the lock at Lanaye. The twin locks at Lanaye form the connection with the Albert-canal. This narrow junction is known as the "Stopper of Lanaye". The lock at St. Pieter is provided with floating rolling lock gates, which are kept pressed down by a traffic bridge. The filling of the lock chamber takes place by means of short culverts with valves.

By the construction of a **ship-channel** the river section at the place of the bridges has been widened. The historic St. Gervase bridge had therefore to be rebuilt drastically. The channel is 50.- m. wide, the bottom lies 5.00 m. below the retaining level. It has not yet been necessary to dredge the channel, in behalf of the maintenance of the depth.

By the **Bosscheveld-lock** (completed in 1931) the Maastricht-'s-Hertogenbosch canal (constructed from 1821 to 1826) is accessible directly from the canalized Meuse.
Owing to the construction of the locks at St. Pieter and at Bosseveld the passage of the narrow canal-system through Maastricht has become superfluous for through-navigation.
A **feed-culvert syphon** feeds the Maastricht-'s-Hertogenbosch canal with about 15 m^3/sec.
The different modifications in the winter-bed downstreams of Maastricht, made the construction of a **discharge-canal** with spill-way necessary. This discharge-canal debouches into the Meuse downstreams of the weir at Borgharen.
The canal compensates the limitation of the capacity of the winter-bed, caused by the dikes of the Juliana-canal on the one side and the lock at Bosscheveld on the other hand, cutting of a part of the winter-bed. The works at Maastricht started in 1925, were finished in 1935, the total costs being about fl 10.500.000.-.

B. The Juliana-canal.

Canalisation of the Meuse between Borgharen and Maasbracht would have involved the construction of a great number of weirs and locks. The average fall of the Meuse between Maastricht and Linne is 0.44 m. to a km, locally even 1.00 m. to a km. Technical, political and economic factors made the construction of a lateral canal on Netherlands territory desirable.
The construction of this 35 km. long canal - the Juliana-canal - started in 1925 and it has been opened in 1935. The constructioncosts were round fl 30.500.000.-. Normally the canal is over a length of 16 km. in open communication with the canalized Meuse at Maastricht.

The **twin locks at Limmel** are a watch-lock, presenting the possibility to close the canal at the time of high water or ice-drift. The lock is provided with vertical lift gates, with which the filling of the lock chamber is also regulated. The canal further has three locks, with which the difference in water level between Maastricht and Linne (being respectively 44.00 m. + N.A.P. and 20.40 m. + N.A.P.) is overcome.

The **lock at Born** is equipped with vertical lift gates. The filling and emptying of the lock-chamber is regulated with these gates. The lifting velocity of the upper gate is constant. The special shape of the gate in the upper gates which slides past the lower closing, causes, notwithstanding the constant lifting-velocity of this gate, such an increase of the opening and therefore of the inflowing water, that no sharp oscillations occur in the lock-chamber; so the pull on the hawsers of the barges is limited to about $\frac{1}{1000}$ of the weight of the loaded ship.

The gate in the lower sluice-head is provided with a movable section on the lower side. This can be pulled up into the gate. Only after the lock-chamber has been emptied and the pressure on the large gate has been removed, the whole gate is lifted.

With this system no big wheel-pressures are created, because the wheels of the large gate can be pressed inward. (The axles are supported horizontally elastic).

The **locks at Roosteren and Maasbracht** are equipped with mitreing gates and hinged falling gates. The filling of the lock-chamber takes place by means of short culverts, provided with cylindrical valves in the upper sluice-head and rolling vertical lift valves in the lower head. Each lock is provided with a **pumping service,** in order to be able to maintain the water level in the canal pounds by pumping up the water in times of shortage of feed-water.

The **clearance** under bridges and other constructional works across the canal is at least 7.00 m. At Stein is a **port of transhipment** in behalf of the State Mines. Here four cranes are mainted, that take so called "kübels" off the railway-carriages and empty them into the barges.

The capacity per crane averages 250 metric tons an hour. At Born is a port of transhipment in behalf of the private mines. The carriages are being lifted here in whole and tipped over into the barge.

The **brooks** from the hilly country of Limburg are led under the canal towards the Meuse. If required the Geul and the Groenbeek may also be used to feed the Juliana-canal.

At Elsloo it was necessary to make a 26.-- m. deep **cutting,** in very water-bearing layers of fine sand, divided by nearly horizontally lying clay layers. During the execution the sand was drained by means of filterwells.

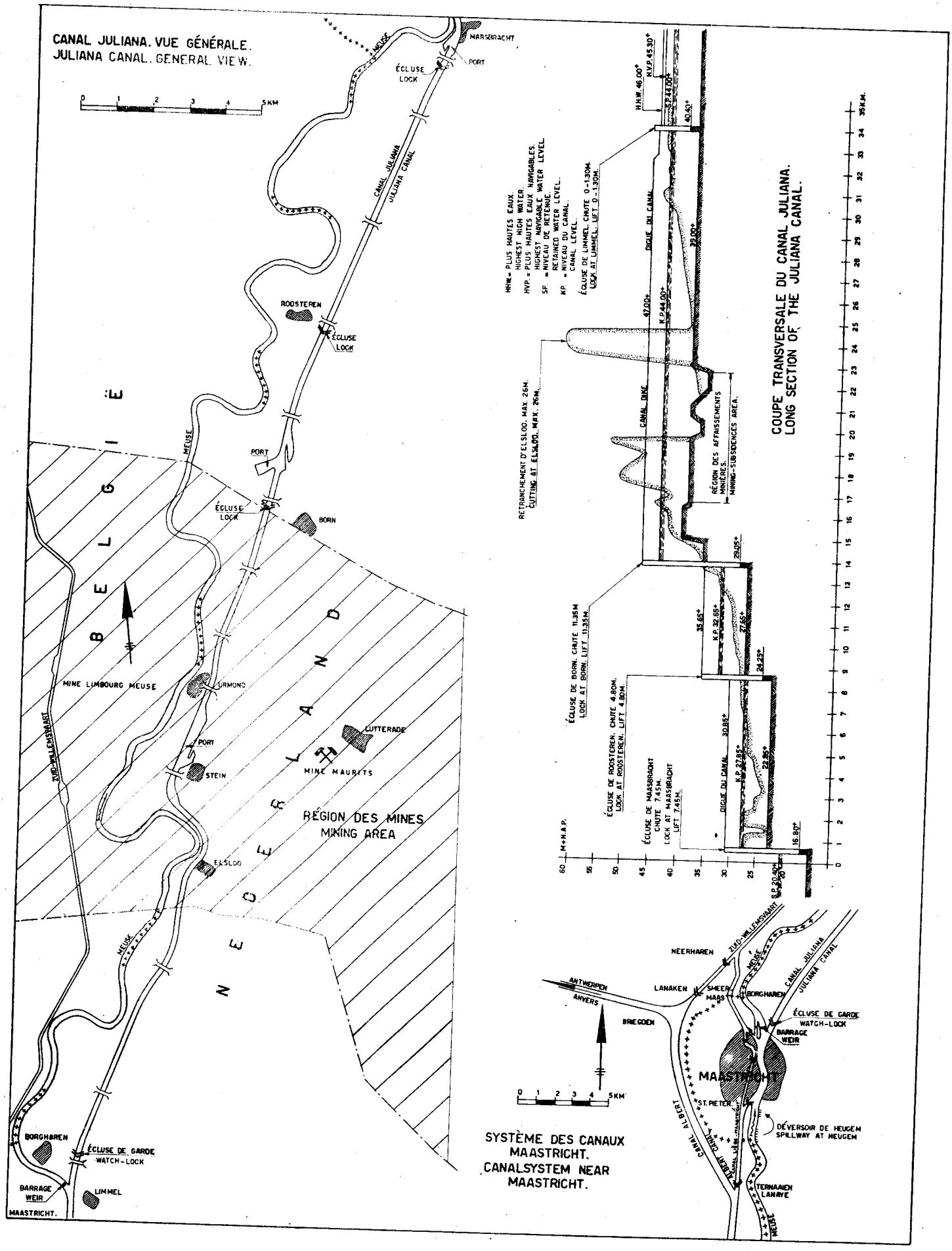
The canal was laid in a drainage bed of gravelly sand. A drainage-culvert leads the subsoil water, flowing from the higher grounds, towards the Meuse. A waterproof bitumen and clay layer prevents the flowing away of the canal water via the drainage bed.

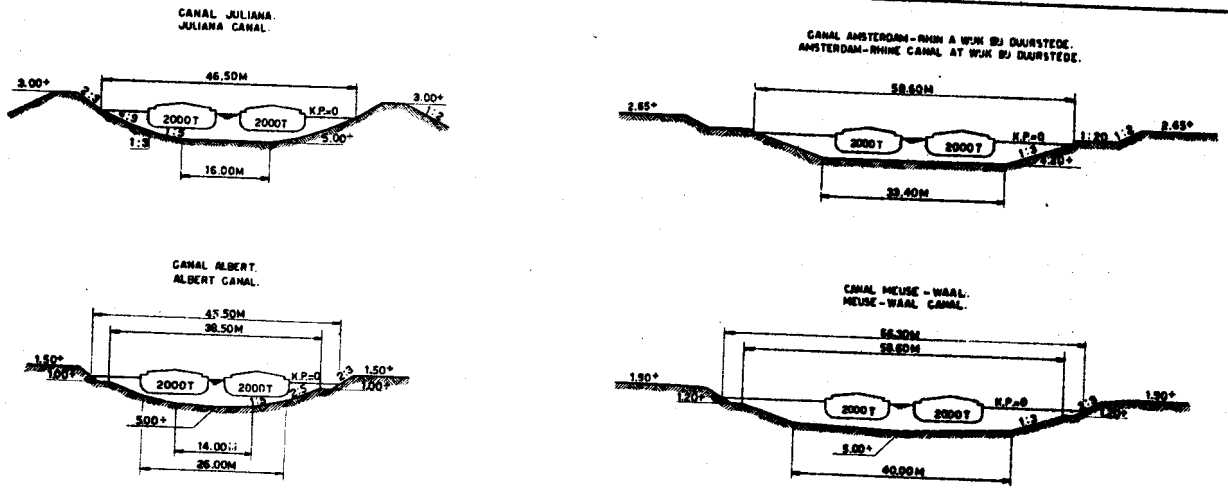
At Stein **mining-subsidences** occur as a result of the exploitation of the State Mine "Maurits". A total subsidence of at least 8.00 m. has to be counted with. The subsidence amounts locally already to nearly 3.00 m. The canal dikes, the revetments and the sheet-piling of the ports have to be raised regularly in the subsidence area.

The bridges near Stein and Urmond had to be jacked up already. The bridges near Urmond and Berg had been laid at the time of construction 2.00 m. higher than was directly necessary.

Data concerning the locks at Maastricht and in the Juliana-canal.

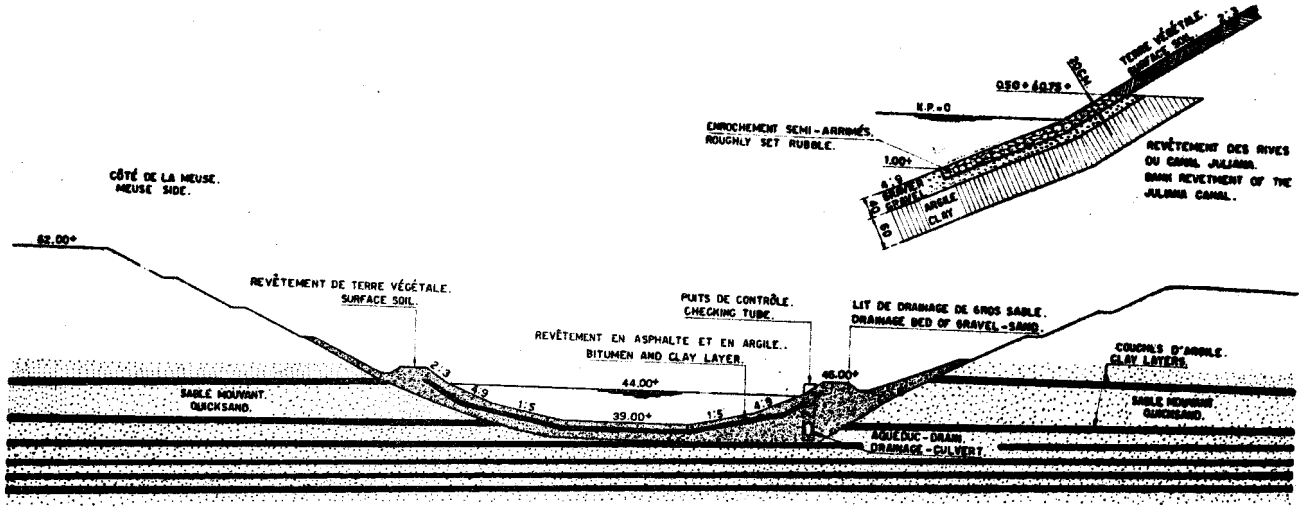
Lock at	Carrying-capacity of largest barge in metric tons.	Effective length of lock-chambre in m.	Width of lock-chamber in m.	Entrance width in m.	Depth of sill in m.	Lift in m.
Lanaye (Belgium)	600 t.	55	7,5	7,5	3,00	10,80
St. Pieter	1000 t.	105	15	12	3,25	2,70-3,80
Bosscheveld	2000 t.	136	16	14	3,60	max. 5,07
Borgharen	600 t	55	7,5	7,5	2,80	max. 4,00
Limmel	2000 t	136	16	16	3,60	0-1,30
Born	2000 t.	136	16	14	3,60	11,35
Roosteren	2000 t.	136	16	14	3,60	4,80
Maasbracht	2000 t	136	16	14	3,60	7,45


CANAL JULIANA. VUE GÉNÉRALE.
JULIANA CANAL. GENERAL VIEW.
0 1 2 3 4 5KM
MAASBRACHT
PORT
ÉCLUSE LOCK
MEUSE
CANAL JULIANA
JULIANA CANAL
ROOSTEREN
ÉCLUSE LOCK
BELGIË
PORT
MEUSE
ÉCLUSE LOCK
BORN
MINE LIMBOURG MEUSE
URMOND
PORT
STEIN
ZUID-WILLEMSVAART
CUTTERADE
MINE MAURITS
NEDERLAND
RÉGION DES MINES
MINING AREA
EASLOO
MEUSE
BORGHAREN
ÉCLUSE DE GARDE
WATCH-LOCK
BARRAGE
WEIR
LIMMEL
MAASTRICHT.
HHW = PLUS HAUTES EAUX.
HIGHEST HIGH WATER.
HVP. = PLUS HAUTES EAUX NAVIGABLES.
HIGHEST NAVIGABLE WATER LEVEL.
SP. = NIVEAU DE RETENUE.
RETAINED WATER LEVEL.
K.P. = NIVEAU DU CANAL.
CANAL LEVEL.
ÉCLUSE DE LIMMEL. CHUTE 0-13.20M.
LOCK AT LIMMEL. LIFT 0-13.20M.
RETRANCHEMENT D'EL 51.00. MAX. 26M.
CUTTING AT EL 51.00. MAX. 26M.
H.H.W. 46.00+
H.V.P. 45.30+
S.P. 44.00+
40.40+
39.00+
47.00+
K.P. 44.00+
DIGUE DU CANAL
CANAL DIKE
RÉGION DES AFFAISSEMENTS MINIÈRES.
MINING-SUBSIDENCES AREA.
29.05+
35.65+
K.P. 32.65+
27.65+
24.25+
ÉCLUSE DE BORN. CHUTE 11.35M
LOCK AT BORN. LIFT 11.35M.
ÉCLUSE DE ROOSTEREN. CHUTE 4.80M.
LOCK AT ROOSTEREN. LIFT 4.80M.
ÉCLUSE DE MAASBRACHT
CHUTE 7.45M.
LOCK AT MAASBRACHT
LIFT 7.45M.
30.05+
K.P. 27.85+
22.85+
DIGUE DU CANAL
16.80+
M.N.A.P.
S.P. 20.40+
60 55 50 45 40 35 30 25 20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 KM.
COUPE TRANSVERSALE DU CANAL JULIANA.
LONG SECTION OF THE JULIANA CANAL.
NEERHAREN
ZUID-WILLEMSVAART
MEUSE
CANAL JULIANA
JULIANA CANAL
ANTWERPEN
ANVERS
LANAKEN
SMEER
MAAS
BORGHAREN
BRIEGDEN
ÉCLUSE DE GARDE
WATCH-LOCK
BARRAGE
WEIR
MAASTRICHT
ST. PIETER
CANAL ALBERT
DÉVERSOIR DE HEUGEM
SPILLWAY AT HEUGEM
TERNAAIEN
LANAYE
MEUSE
0 1 2 3 4 5KM
SYSTÈME DES CANAUX MAASTRICHT.
CANALSYSTEM NEAR MAASTRICHT.



PROFIL TRANSVERSAL DU CANAL JULIANA EN COMPARAISON D'AUTRES CANAUX.
CROSS-SECTION OF THE JULIANA CANAL IN COMPARISON WITH OTHER CANALS.

0 10 20 30 40 50M

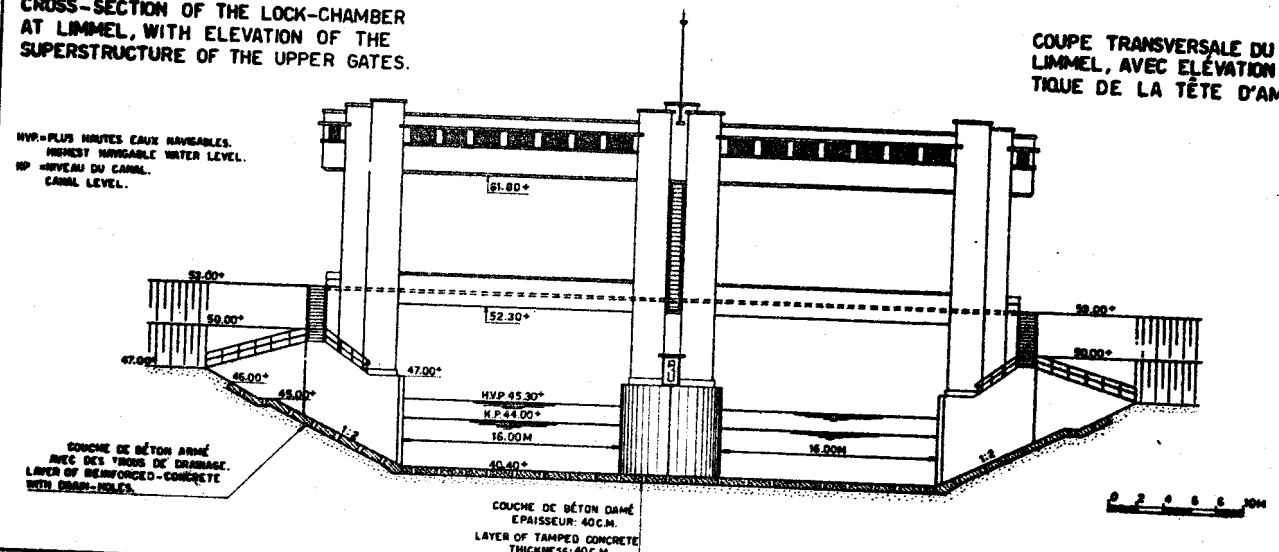


PROFIL TRANSVERSAL DU RETRANCHEMENT D'ELSLOO.
CROSS-SECTION OF THE CUTTING AT ELSLOO.

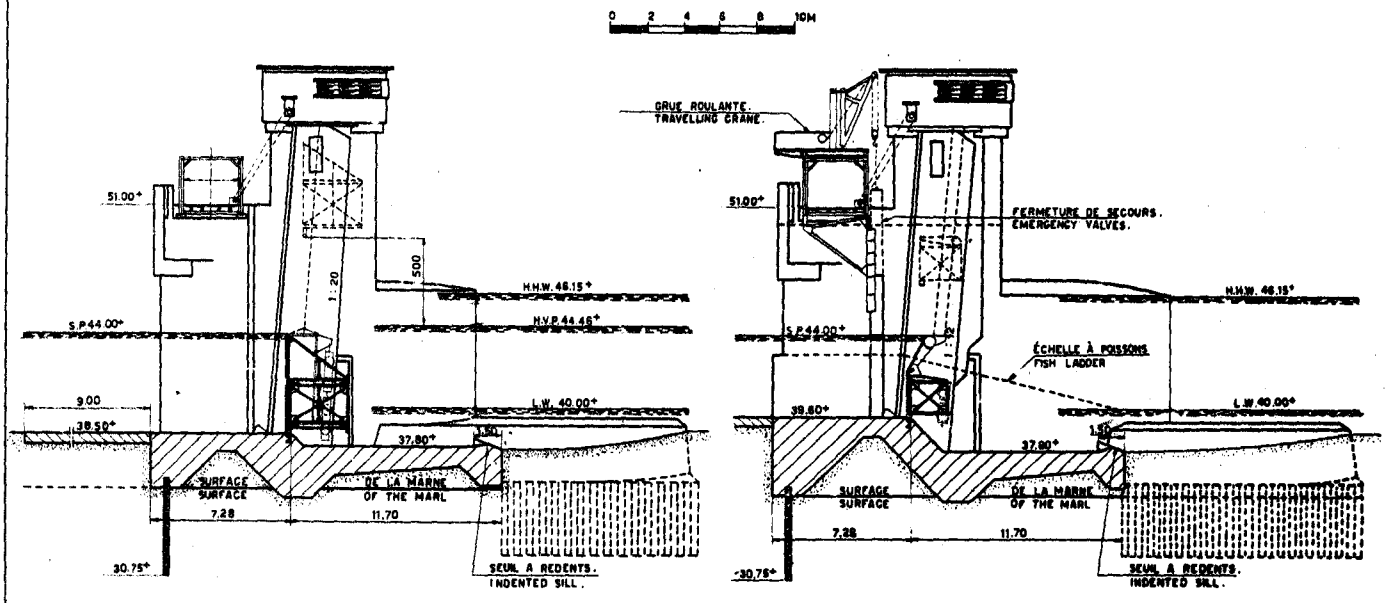
0 10 20 30 40 50M

CROSS-SECTION OF THE LOCK-CHAMBER AT LIMMEL, WITH ELEVATION OF THE SUPERSTRUCTURE OF THE UPPER GATES.

COUPE TRANSVERSALE DU SAS DE LIMMEL, AVEC ELÉVATION DU PORTIQUE DE LA TÊTE D'AMONT.

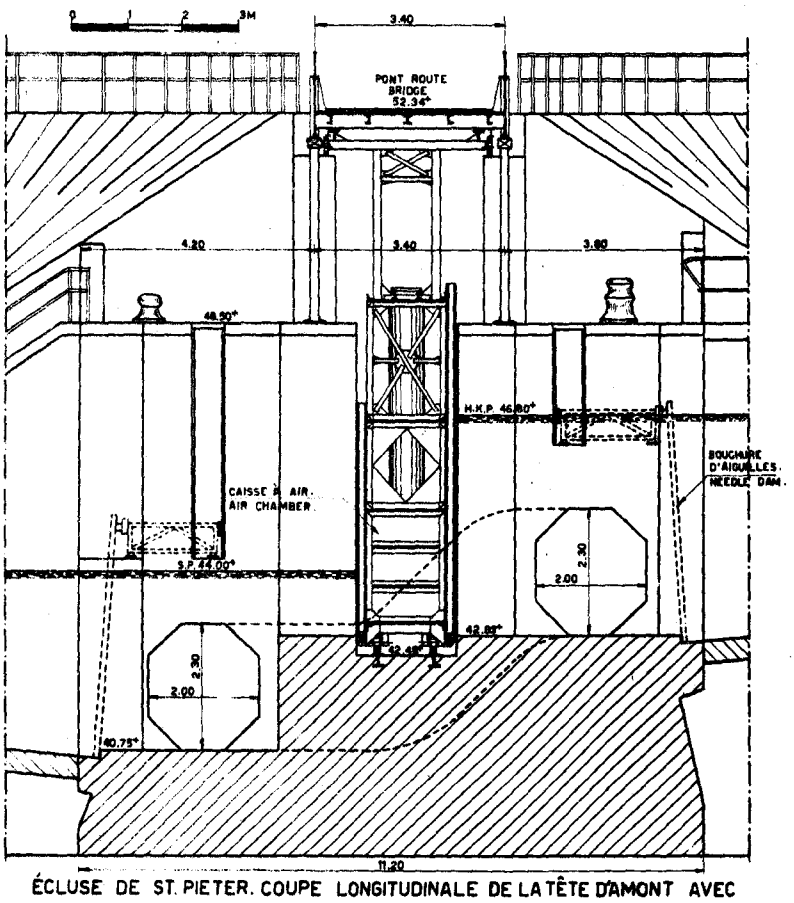


BARRAGE DE BORGHAREN.
WEIR AT BORGHAREN.

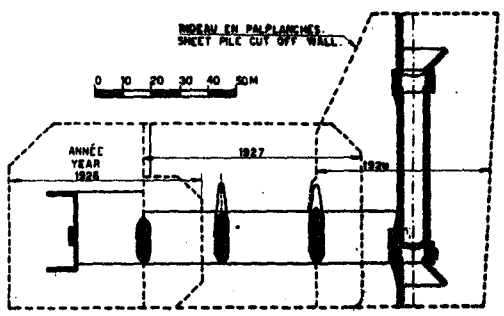


PASSE NAVIGABLE.
NAVIGABLE OPENING.

PASSE DÉVERSOIR.
DISCHARGE OPENING.

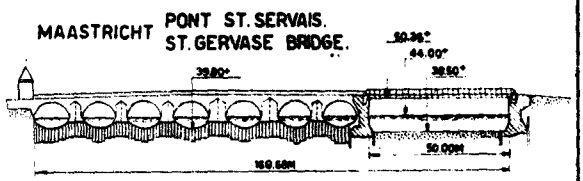


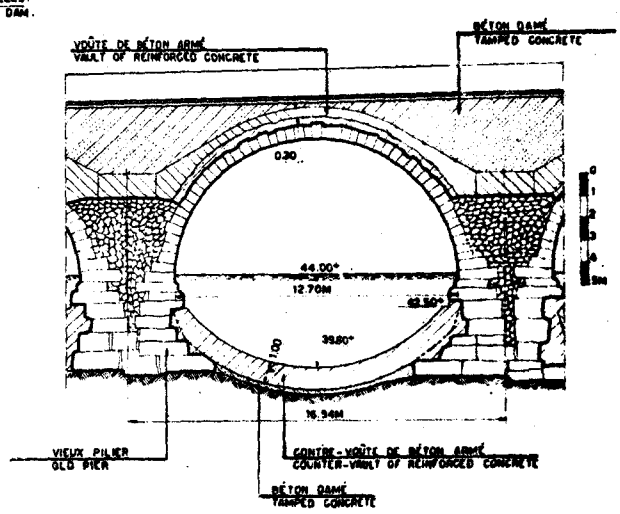
ÉCLUSE DE ST. PIETER. COUPE LONGITUDINALE DE LA TÊTE D'AMONT AVEC LA PORTE ROULANTE.
LOCK AT ST. PIETER. LONGITUDINAL SECTION OF THE UPPER GATES WITH THE ROLLING LOCK GATE.



SCHÈME DE L'EXÉCUTION DU BARRAGE D. BORGHAREN.
SCHEME OF THE CONSTRUCTION OF THE WEIR AT BORGHAREN.

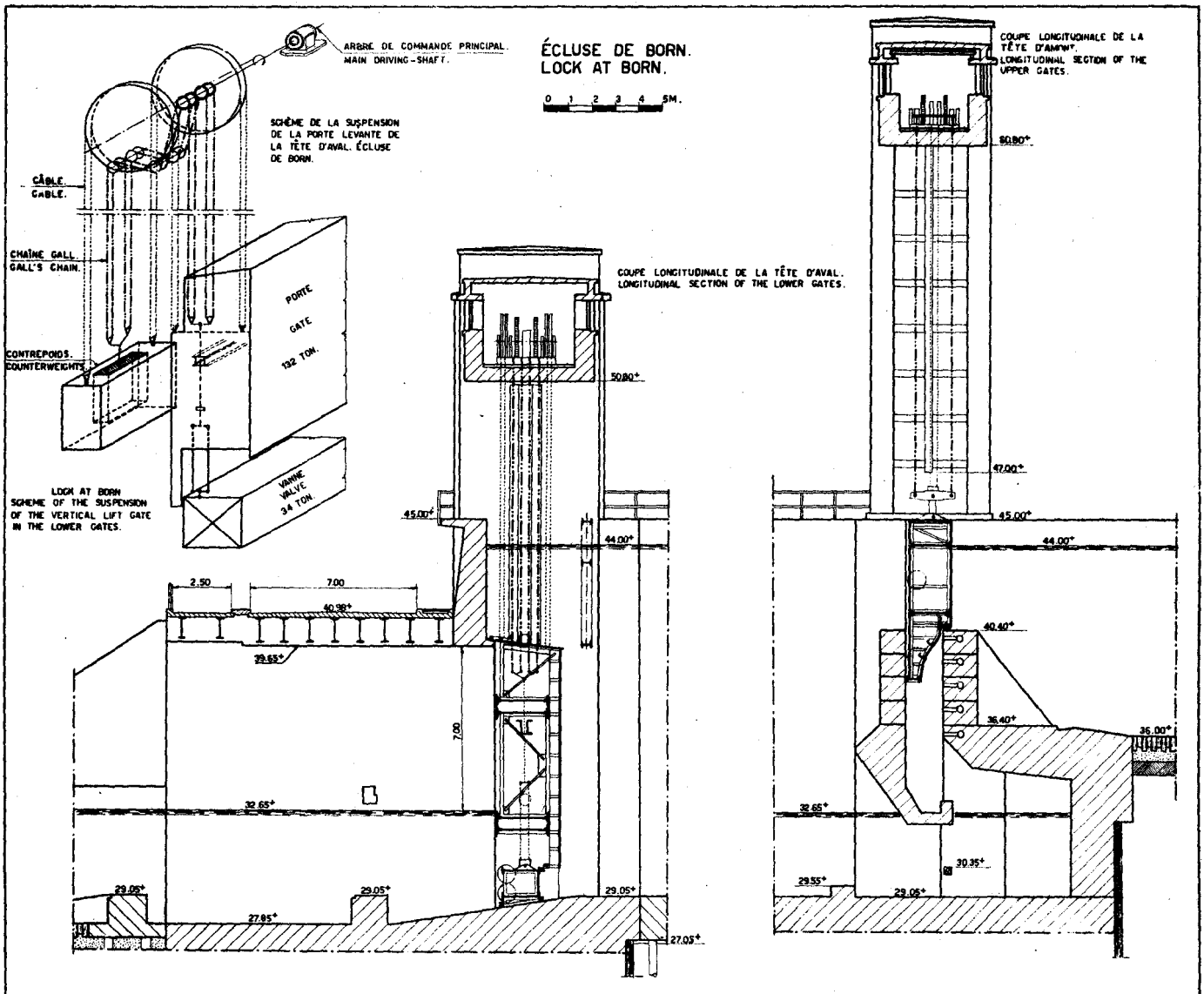
MAASTRICHT PONT ST. SERVAIS.
ST. GERVASE BRIDGE.

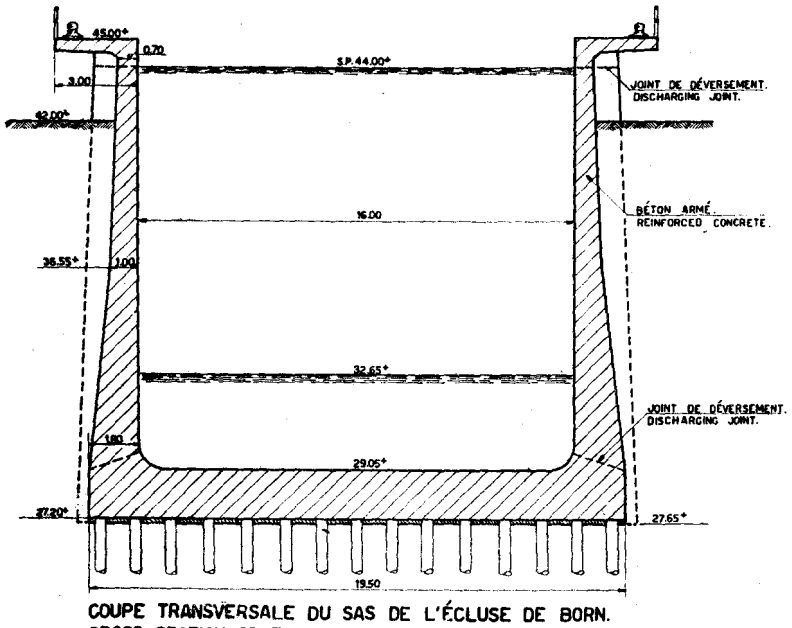




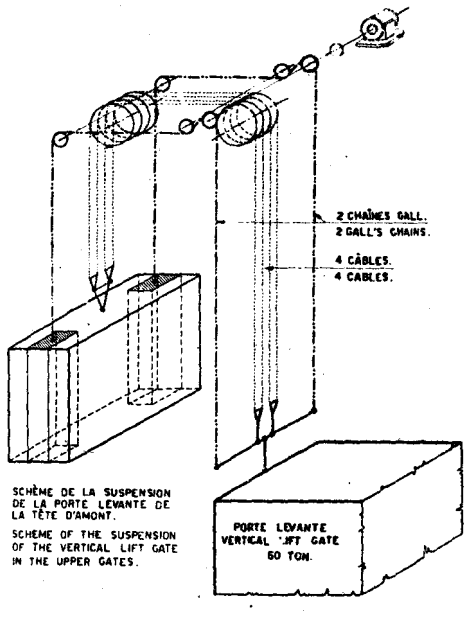
ÉCLUSE DE BORN.
LOCK AT BORN.

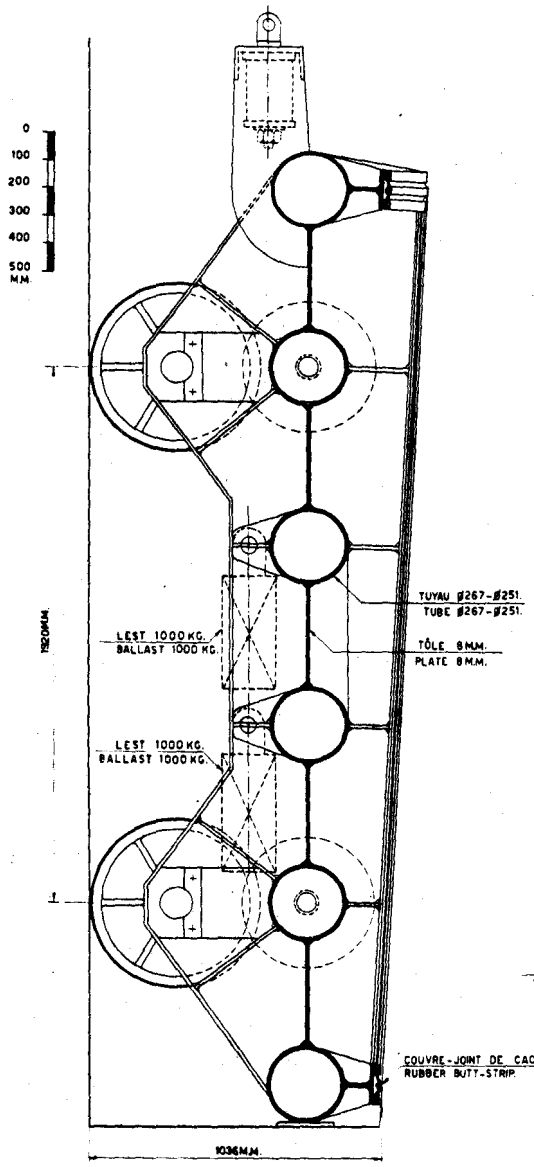
0 1 2 3 4 5M.



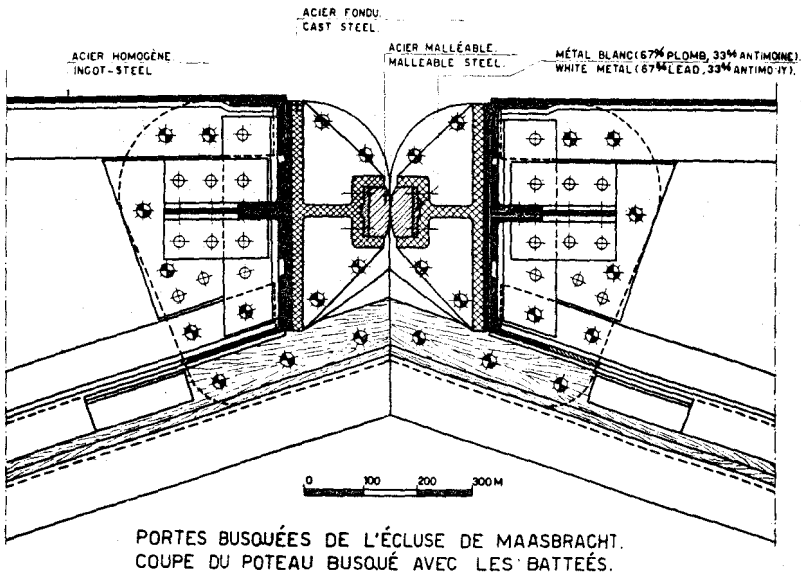


COUPE TRANSVERSALE DU SAS DE L'ÉCLUSE DE BORN.
CROSS SECTION OF THE CHAMBER OF THE LOCK AT BORN.

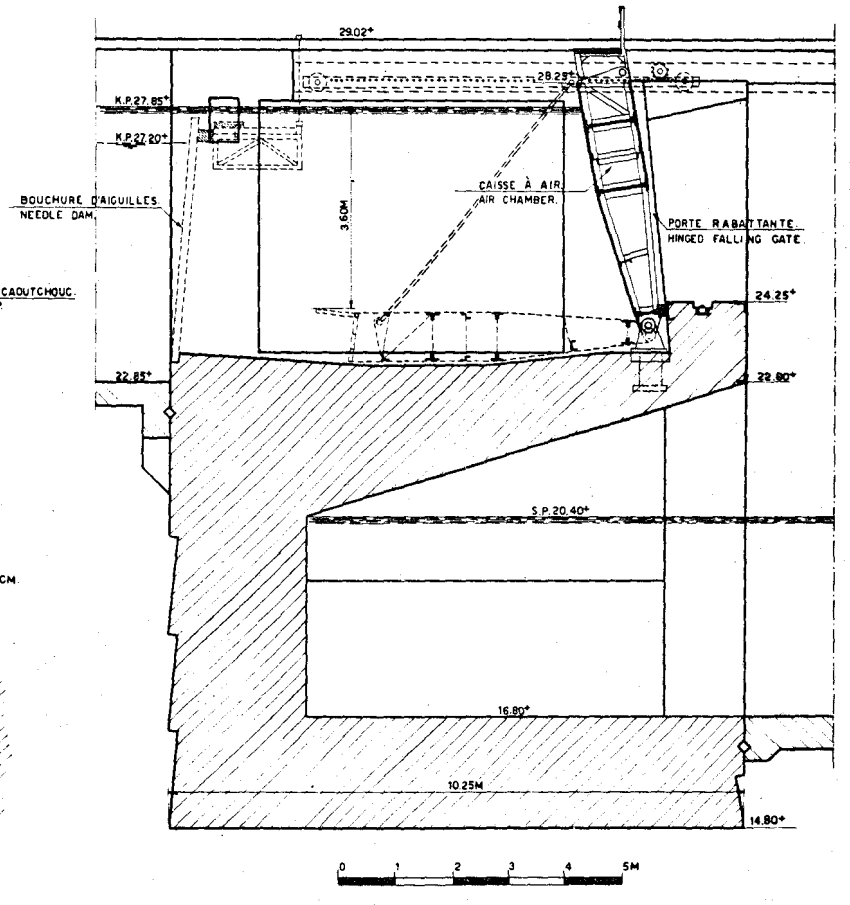




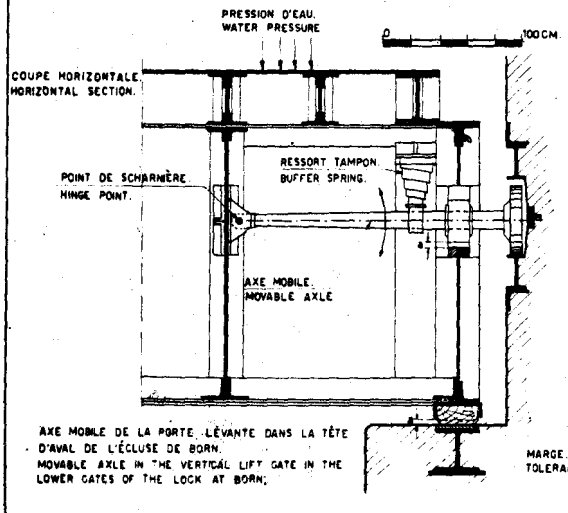
COUPE DE LA VANNE WAGON DE L'AQUEDUC DE L'ÉCLUSE DE MAASBRACHT.
SECTION OF THE ROLLING VERTICAL LIFT VALVE IN THE CULVERT OF THE LOCK AT MAASBRACHT.



PORTES BUSQUÉES DE L'ÉCLUSE DE MAASBRACHT.
COUPE DU POTEAU BUSQUÉ AVEC LES BATTEÉS.
MITREING GATES OF THE LOCK AT MAASBRACHT.
SECTION OF THE MITRE POST WITH RUBBING FACES.

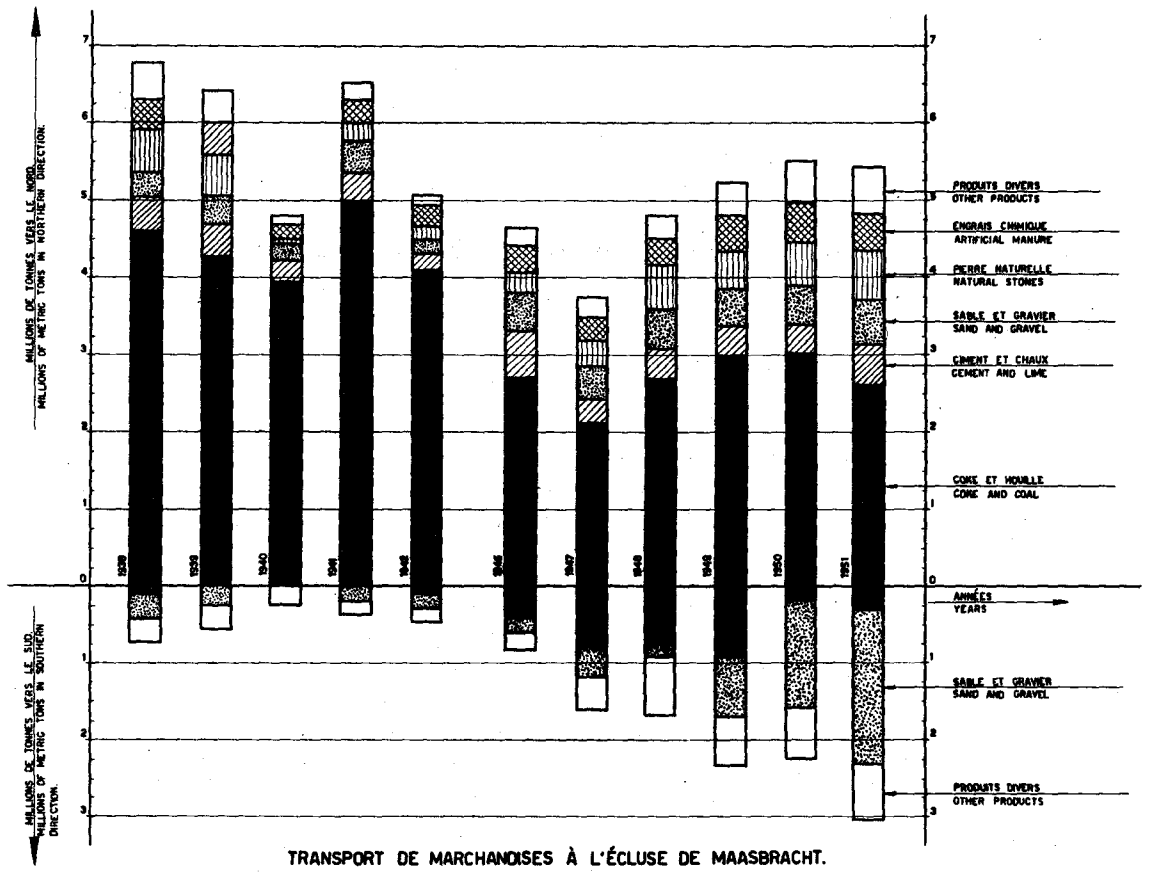


COUPE DE LA TÊTE D'AMONT DE L'ÉCLUSE DE MAASBRACHT.
SECTION OF THE UPPER GATES OF THE LOCK AT MAASBRACHT.



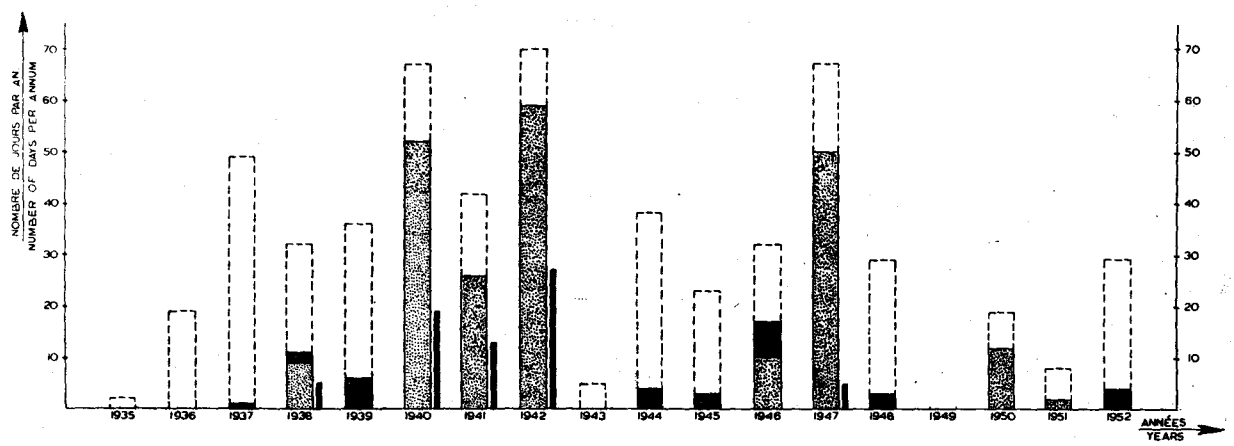
AXE MOBILE DE LA PORTE LÉVANTE DANS LA TÊTE D'AVAL DE L'ÉCLUSE DE BORN.
MOVABLE AXLE IN THE VERTICAL LIFT GATE IN THE LOWER GATES OF THE LOCK AT BORN.

MARGE. a = 15 - 20 M.M.
TOLERANCE. a = 15 - 20 M.M.



TRANSPORT DE MARCHANDISES À L'ÉCLUSE DE MAASBRACHT.
GOODS-CARRYING-TRAFFIC IN THE LOCK AT MAASBRACHT.

STAGNATION DE LA NAVIGATION DIRECTE SUR LE CANAL JULIANA.
BLOCKING-UP OF THE THROUGH-NAVIGATION ON THE JULIANA-CANAL.



LÉGENDE.

STAGNATION PAR SUITE DE GLACE DÉRIVANTE.

STAGNATION PAR SUITE DE DÉPASSEMENT DES EAUX NAVIGABLES PRÈS DE LIMMEL (45.30 M. + N.A.P.)

NAVIGATION PRÈS DE LIMMEL PENDANT DES HAUTEURS D'EAU ENTRE LE NIVEAU DE RETENUE ET LE NIVEAU D'EAU NAVIGABLE.

BARRAGE DE BORGHAREN OUVERT À CAUSE DE GLACE DÉRIVANTE.

LEGEND.

BLOCKING-UP DUE TO ICE-DRIFT.

BLOCKING-UP IN CONSEQUENCE OF EXCEEDING THE NAVIGABLE WATER LEVEL AT LIMMEL (45.30 M. + N.A.P.)

NAVIGATION AT LIMMEL DURING WATER LEVELS BETWEEN RETAINING LEVEL AND NAVIGABLE WATER LEVEL.

WEIR AT BORGHAREN OPENED BECAUSE OF ICE-DRIFT.