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MEMORANDUM FOR: The Director of Central Intelligence

FROM : John N. McMahon
Deputy Director for Operations

SUBJECT : MILITARY THOUGHT (USSR): Negotiating Rivers in a Border Zone During the Movement Forward and Deployment of Front Troops

1. The enclosed Intelligence Information Special Report is part of a series now in preparation based on the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal 'Military Thought". This article addresses the question of providing reliable support for troops crossing water obstacles in a border zone under conditions applicable to the Western Theater of Military Operations. After assessing the vulnerability of various types of permanent bridges to destruction by various yields and types of nuclear bursts, the author proposes paralleling the bridges with various types of crossings, and mainly with pontoon bridges which are most effective. He further examines the organization of parallel crossings using pontoon bridges, the capabilities and conditions for this, the necessary allocation of bridge sets to the troops, and the forces required to employ them in the front zone. Finally, he mentions the plan for organizing river crossings both for troops and for the civilian population. This article appeared in Issue No. 1 (71) for 1964.

2. Because the source of this report is extremely sensitive, this document should be handled on a strict need-to-know basis within recipient agencies. For ease of reference, reports from this publication have been assigned

John N. McMahon

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SUBJECT

MILITARY THOUGHT (USSR): Negotiating Rivers in a Border Zone During the Movement Forward and Deployment of Front Troops

SOURCE Documentary

Summary:

The following report is a translation from Russian of an article which appeared in Issue No. 1 (71) for 1964 of the SECRET USSR Ministry of Defense publication Collection of Articles of the Journal "Military Thought". The author of this article is General-Mayor of Engineer Troops S. Aganov. This article addresses the question of providing reliable support for troops crossing water obstacles in a border zone under conditions applicable to the Western Theater of Military Operations. After assessing the vulnerability of various types of permanent bridges to destruction by various yields and types of nuclear bursts, the author proposes paralleling the bridges with various types of crossings, and mainly with pontoon bridges which are most effective. He further examines the organization of parallel crossings using pontoon bridges, the capabilities and conditions for this, the necessary allocation of bridge sets to the troops, and the forces required to employ them in the front zone. Finally, he mentions the plan for organizing river crossings both for troops and for the civilian population.

End of Summary

[redacted] Comment:

The author also collaborated with Colonel M. Bragin on "Predicting and Negotiating Zones of Destruction" in Issue No. 1 (77) for 1966

[redacted] The SECRET version of Military Thought was published three times annually and was distributed down to the level of division commander. It reportedly ceased publication at the end of 1970. [redacted]

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Negotiating Rivers in a Border Zone During the Movement Forward and Deployment of Front Troops

by

General-Mayor of Engineer Troops S. AGANOV

The rapid deployment of front troops in the initial period of a war for going over to a decisive offensive following nuclear strikes is acquiring extraordinary importance. In order for the front troops to carry out deployment, it is necessary to resolve a number of serious problems, among which reliable support for troops crossing water obstacles in a border zone occupies an important place.

Under the conditions of the Western Theater of Military Operations which has a sufficiently developed road network, as in other theaters, while large units and units are moving forward in constant combat readiness the main obstacle certainly will be the numerous rivers, especially the medium and wide ones.

As we know, our probable enemies attach great importance to the destruction of bridges and crossings on water obstacles and to the creation of nuclear "barriers" out of them in the depth of the disposition of border military districts, calculating by this to disrupt the regular movement forward and deployment of the troops. Thus, during one of the major exercises of the NATO armed forces in the Central European Theater of Military Operations, it was planned that all the existing bridge crossings on the Oder, Neisse, Elbe, and Saale rivers be destroyed by nuclear strikes. During another exercise, tactical aviation alone, of the 200 targets assigned to it, delivered strikes against 45 large highway and railroad bridges in the territory of the deployed "enemy" front. We, naturally, cannot ignore all of this.

The high degree of striking accuracy and the destructive force of missile/nuclear weapons enable such stationary and important targets as permanent bridges on wide and medium rivers to be put out of service comparatively easily. Metal bridges with a span of 30 to 45 meters which are most often found in the Western Theater of Military Operations can be destroyed with a frontal shock wave overpressure of 1.5 kilograms per

square centimeter, and reinforced concrete bridges with a span of 20 to 25 meters -- 1.2 kilograms per square centimeter. Even less resistant to the effects of a nuclear burst are wooden low-level bridges and floating bridges from authorized parks. The first are destroyed at an overpressure of 0.6 to 1.0 kilograms per square centimeter, and the second -- at 0.4 to 0.8 kilograms per square centimeter.

To destroy bridges the enemy will most likely employ nuclear warheads with a yield of from several tens to two to three hundreds of kilotons as the most effective weapons for these targets.

On the basis of graphs and tables of the destructive action of the shock wave found in official reference books and guides, we have calculated the radiuses of the zones in which, depending on the yield and type of nuclear bursts, various types of bridges are put out of service. Thus, metal bridges with a span of 30 to 45 meters, from air bursts of nuclear warheads having a yield of 30, 100, and 300 kilotons, are destroyed at a radius of 540, 810, and 1,160 meters, respectively, and from ground bursts -- at a radius of 720, 1,100, and 1,570 meters. The radius of the zone of destruction of reinforced concrete bridges with a span of 20 to 25 meters under analogous conditions increases a total of seven to eight percent. Metal bridges with a span of 100 to 150 meters are put out of service by the air burst of nuclear warheads having the aforementioned yield at a radius of 800, 1,150, and 1,700 meters; and by a ground burst -- of 930, 1,400, and 2,000 meters, respectively.

As regards wooden low-level bridges and floating bridges from authorized parks, during air bursts of nuclear warheads having the yields indicated in our examples, the former are destroyed in zones with a radius of 1,000, 1,500, and 2,200 meters (with ground bursts -- 800, 1,150, and 1,700 meters), and the latter -- 1,400, 2,100, and 3,000 meters (with ground bursts -- 900, 1,300, and 1,900 meters), respectively.

It is obvious from the data cited that even metal and reinforced concrete bridges, which are the most resistant to the effect of a shock wave, are put out of service at a radius of 540 to 2,000 meters from ground zero (the center) of a nuclear burst. It is interesting to note that with identical yields of nuclear warheads the zone of destruction of metal and reinforced concrete bridges is greater with ground bursts, whereas the zone of destruction of low-level wooden bridges and floating bridges is greater with air bursts.

It is natural that the enemy will most often employ these very ground bursts in delivering strikes against permanent bridges on the lines of transportation of a deploying front. Such a conclusion is confirmed by the experience of a majority of the NATO troop exercises, in which it was planned to destroy bridges on wide rivers with ground bursts of nuclear warheads, and in addition, to create, thereby, zones of contamination with high levels of radiation on the water obstacles.

Consequently, owing to their great vulnerability, the permanent bridges, despite the number of them on large rivers, do not guarantee an uninterrupted troop crossing. This, of course, does not mean that measures should not be taken for the maximum protection and utilization of these bridges. When the enemy's initial and subsequent nuclear strikes are successfully disrupted, bridges are covered against air strikes, and there is reliable protection against the actions of sabotage groups, the crossing of the troops moving forward for an offensive can be carried out on bridges built in advance. However, for the purpose of supporting the rapid and organized negotiation of water obstacles in the depth of a border zone under conditions of complete or partial destruction of the existing bridges and crossings, and in a complex radiation situation, it will be necessary to conduct a series of measures both in peacetime, and in the course of troop deployment.

What sort of measures might these be?

In our opinion, the attempt to have water-crossing means in the advancing troop columns in order to provide them independence in negotiating water obstacles is obviously unrealistic, since a huge number of means will be required for this, and the effect of their utilization will be minor.

It seems to us that one of the advisable ways, if not the only way, to resolve this problem is the paralleling, carried out in advance and carefully organized on the scale of the front, of bridges which have been destroyed with various types of crossings, the total capacity of which would not decrease the prescribed rate of advance and deployment of troops. Accordingly, the chief requirement should be achieved -- speed in putting the parallel crossings into operation, not counting the long delay of the troops at the water obstacle, and permitting the crossing to be carried out without significant reorganization of the march columns.

Bridges from pontoon bridge parks and local river floating means, low-level bridges and submerged wooden bridges made of prefabricated

components, as well as ferries made of authorized and local means can be widely employed as parallel crossings. In addition, it is necessary to utilize deep fords and routes which have been prepared in advance for the underwater crossing of tanks.

The effectiveness with which each of the enumerated types of crossings is employed can be determined by comparing the basic indices of these crossings cited in the table, and first, the times required to ready the crossings, which have decisive importance. A river with a width of 200 meters was taken for the calculations. The time for the assembly of the units on the basis of an alert signal and the movement into the area of the work at a distance of 20 to 25 kilometers was set at 1.5 to two hours. The time norms for the preparation of the crossings were taken with reference to the results of the special training of the forward engineer units in the 1962 academic year.

Analysis of the data cited in the table shows that parallel bridges from pontoon bridge parks which are deployed on the water beforehand when a state of increased combat readiness is being introduced in the area designated for the laying of the bridge, as well as floating bridges from authorized parks of pontoon bridge units of the front and armies, can be prepared fastest of all. Their preparation time, including the assembly on the basis of an alert signal and movement forward into the work area of the unit allocated for this, will not exceed two to six hours.

All the remaining bridges require prolonged time periods for construction (seven to 12 hours or more) and therefore, they will not be able to support the timely movement forward of the front troops in the event that the existing bridges are destroyed. The construction of such bridges as alternate crossings on rivers in the depth of the border zone can be begun, in our opinion, only if the troops are deployed in advance under the guise of exercises.

When river crossings are being supported in zones of radioactive contamination, parallel bridges from pontoon bridge parks have an indisputable advantage. The crews working with the parks are small and the length of their stay in the danger area until the bridge-laying is completed is short. In connection with this, the crews may receive radiation doses three to four times lower than the personnel building low-level wooden bridges from prefabricated local floating means. When such bridges are being built in a zone even with comparatively low levels of radiation (20 to 25 roentgens per hour at the beginning of the work) it is necessary either to wait for the radiation level to drop, or to carry

out the work by relieving the crews in the danger areas several times, considerably increasing, in so doing, the already great number of affected personnel.

The short period of time required for crossings made from pontoon parks to be made ready make it possible for water obstacles to be negotiated by troops without delay, and enable the combat effectiveness of the units which prepared the parallel bridges to be maintained. In addition, a crossing on a new axis can be organized quickly and a timely maneuver with parallel bridges can be carried out, which is very important when there is the threat of the delivery of repeated enemy strikes while the front troops are being deployed.

Thus, it is possible to ensure the timely and uninterrupted crossing of water obstacles by advancing troops in the event that the existing bridges are destroyed, in our opinion, only when pontoon bridge parks are employed. However, the utilization of the authorized pontoon bridge means of the front and armies for this purpose, as often occurs during command-staff exercises and war games, can place the subsequent assault crossing of rivers by troops in the first days of the offensive under the threat of a breakdown.

During a front offensive operation in the initial period of a war, obviously there will be only a small number of pontoon bridge units in constant combat readiness, and it will be impossible to allocate from this number anything specifically for the paralleling of crossings. For this very reason in the exercises the successive utilization of pontoon bridge units of the front and armies is usually planned: at first -- to parallel crossings on rivers in the depth of the border zone, and then, after the advancing troops have moved into battle formation -- to support from the march the assault crossing of water obstacles being encountered.

The capability of such utilization of authorized pontoon bridge parks of the front and armies depends mainly on the distance from the state border of the rivers where the parallel crossings are carried out, the number of troops making the crossing, the rate of advance of the first-echelon large units of the front, and the average rate of march of the pontoon bridge units.

In our opinion, the capability of utilizing the pontoon bridge units allocated for paralleling crossings in the border zone, for the assault crossing of rivers in the course of an operation which has begun, can be most simply and quickly determined with the aid of the graphic method (see

diagram). From this same diagram it is easy to calculate the time limits for the removal of pontoon bridge units from one river for the purpose of moving them forward to another during the successive assault crossing of water obstacles.

The diagram given was compiled on the basis of the following data: the average rate of advance of the first-echelon troops is 100 kilometers per day, with their greatest progress made during daylight; pontoon bridge units carry out a march at a rate of 25 kilometers per hour along separate routes, and 20 kilometers per hour if such routes have not been allocated. As a result of the winding of the roads the actual extent of their course is 30 percent greater than the distances indicated on the chart. After a march of 300 kilometers a halt of four to six hours is planned for the refueling of vehicles and rest for the personnel. The airlifting of pontoon parks can be carried out at a rate of up to 200 kilometers per hour. Naturally, other initial data could also be taken in drawing up the diagram.

The diagram enables us to rapidly, although a bit roughly, determine within how much time and at what distance the pontoon bridge unit will overtake the battle formations of the troops. In so doing, the location of the crossing and time expended on laying the bridge, crossing the troops, opening the bridge, loading equipment, and forming a unit into a column for movement are taken into consideration.

Let us examine two examples. The first example. A pontoon unit supports the crossing of two divisions and army units (total length of the column is 260 to 280 kilometers) across a river 50 kilometers from the state border. The laying of the bridge and the preparation of the unit for the march takes 16 hours. Separate routes are not allocated for the pontoon unit. On the diagram at river "A" from the point corresponding to 16 hours, let us draw a straight line parallel to line 1 to intersect the line of a troop advance and determine that the pontoon unit will not overtake the troop battle formations until the morning of the second day at a distance of 110 to 115 kilometers from the state border.

The second example. River "B" is 200 kilometers from the state border. The pontoon park will be occupied at the crossing for twelve hours; a separate route has been allocated for moving it. If we draw a straight line parallel to line 2 from the point corresponding to 12 hours, and take into account a six-hour stop following the 300-kilometer march, we will determine that the pontoon unit will overtake the troop battle formations towards the end of the second day at a distance of 160 to 170

kilometers from the state border.

The diagram given enables us in retrospect to quickly determine when a pontoon park should be taken from a parallel crossing in order that there be enough time for the assault crossing of the next river in the course of the operation.

As calculations show, when the troops advance at a rate of 100 kilometers per day virtually none of the pontoon bridge units allocated to parallel crossings in the border zone will be in a condition to take part in supporting the assault crossing of rivers on the first day of the operation. This situation is true not only for the rivers in the rear of the border zone, but also for those closest to the border, since the closer a river is to the border, the greater the number of troops that will have to cross it. Obviously the pontoon parks cannot be removed from these rivers before the main forces have completed their crossing even after the construction of low-level bridges has been completed, since repeated enemy nuclear strikes are possible.

Consequently, the authorized pontoon bridge parks of pontoon units can be utilized to parallel crossings while the front troops are being deployed, only on the condition that the assault crossing of rivers in the first days of the operation will be ensured even without their preparation.

The hydrographic data of the Western Theater of Military Operations being examined as an example show that in the first two days of an advance our troops will encounter one wide, one or two medium, and several narrow rivers, which would be impossible to negotiate without army and front pontoon bridge parks.

On the basis of what has been said, it seems to us that still in peacetime we must set up reserves of pontoon bridge parks to parallel crossings on large rivers in the border zone. Such parks might be taken from the equipment of pontoon bridge units or they might be parks released after re-equipping these units with water crossing means. In addition, the parks can be prepared by the troops, primarily the military construction units, from very simple materials similar to the wooden parks which were manufactured in massive numbers by the front defense construction directorate during the Great Patriotic War.

In a period of aggravation of the military-political situation, part of these parks should be released on the water and located in areas designated for the laying of parallel bridges. It is desirable to place

the remaining parks in temporary depots close to the crossing sites on all large rivers in the zone of the movement forward and deployment of the front troops. Their delivery to the river and lowering into the water should be carried out while the troops are being brought to a state of increased combat readiness or in a period of threat, no matter how short it might be.

How many reserve parks might be needed to support the crossing of front troops being deployed for an offensive in the event that the existing bridges are destroyed? The number will be determined by the hydrographic features of the border zone, by the conditions under which the troops are billeted in peacetime, and by the plan to deploy them for going over to an offensive.

If, in the zone of the troop movement forward to the departure areas for the offensive and further to the state border, only one wide or medium water obstacle will be encountered, and, for the most part, large units of the second echelons of armies and reserves of the front will be put across it, then they will require eight to ten bridges. This will permit two bridges to be allocated to each division, and the crossing of large units to be carried out successively: first -- large units of the second echelons of armies, and after them -- reserves of the front. In addition, in the zone of each army it will be necessary to have at least one bridge for the crossing of army units, and then for the units of front subordination and the rear services units.

In all, a front formation on each river might simultaneously require 12 to 14 bridges. They all should be reliably paralleled in the event that the enemy destroys them. On a river 200 to 250 meters wide this means 12 to 14 sets of pontoon bridge parks. However, the need for parks might be decreased one and a half to two times if it is possible to put tanks across along deep fords or under water, and to lay part of the bridges under only light loads of from 16 to 20 tons.

Besides that, an effective way to reduce the need for reserve parks is to build trestles in advance in the places designated for the laying of parallel bridges, which will simultaneously shorten the time required for the latter to be made ready. Accordingly, for camouflage purposes, the number of trestles on the river should exceed the actual need for reserve parks if only by two or three times. Trestles built from both shores of the river with a total length of 60 to 80 meters will reduce the need for parks by an additional 25 to 30 percent.

In this manner, in the zone of the front to provide for the paralleling of crossings in the border zone on every river having a width of from 200 to 250 meters, there must be four to six sets of reserve parks. Their employment will enable the troop crossing to be reliably supported in the event that the permanent bridges are destroyed by the enemy, and will make it possible to immediately move forward the authorized pontoon bridge parks of the front and armies to be utilized in the assault crossing of rivers from the march during the advance.

Taking into consideration the great need for parks to parallel crossings when eliminating the aftereffects of enemy nuclear strikes against bridges not only in the border zone, but also on rivers in the interior of the country, as well as the need to rapidly release the expensive authorized parks of the engineer troops so that they can be utilized subsequently during the assault crossing in the course of the operation, in our opinion, it is desirable at this time to resolve the question of the mass production of parallel parks of simple design made from inexpensive materials.

How then can the paralleling of crossings be organized utilizing pontoon bridge parks? Who should employ them and when should this be done? What forces will be required for this in the front zone?

It is known that only the engineer troops, primarily the pontoon bridge units, as well as certain units of the road troops of the rear services, are instructed in working with the parks during peacetime. The number of either of these troops in the front will be extremely limited in the first days of a war. Thus, a front composed of three to four armies might have four or five pontoon bridge regiments, in which case the majority of them will be subordinate to the armies. Other engineer large units and units in constant combat readiness cannot be allocated to work with parks, since there will hardly be enough of them to support the passage of the troops when they are going over to the offensive. Towards the beginning of an operation the rear services of a front will have even fewer forces and means for work with parks.

Consequently, to lay parallel crossings from pontoon bridge parks, which have been concentrated beforehand on large rivers in the border zone, it is necessary to have forces which were specifically designated for this purpose and sufficiently instructed already in peacetime. Such forces, in our opinion, might be bridge reconstruction detachments of the civil defense which are formed from local road and bridge building organizations. Transport and loading means must be placed at their disposal, ensuring the

delivery of parks from warehouses to the river and the rapid assembly of floating parallel bridges, as well as signal communications equipment.

The instruction of the personnel of bridge reconstruction detachments, in our opinion, should be organized in the engineer (pontoon) units of the border military district under the direction of the assistant commanders of the military district civil defense troops. The training practices for these detachments in the laying of parallel bridges can be conducted during special civil defense exercises and during troop exercises.

The sites at which parallel crossings are laid, the procedure for assembling the personnel of the detachments, the signals and commands for paralleling crossings, and the methods for transmitting them should be worked out beforehand. To facilitate control it is desirable that the bridge reconstruction detachments be subordinate to the commandants of the road zones and areas when there is notification of a threatening situation, and, after these detachments have been relocated, they obviously should remain in their own sectors of the rivers at the disposal of the local authorities.

Considering that during a sudden enemy attack it might take somewhat longer to assemble the bridge reconstruction detachments of the civil defense than the military units in constant combat readiness, it is necessary to stipulate a variant for the laying of parallel bridges from reserve parks using forces of engineer pontoon units of the military district which have been reinforced in advance and are deployed close by. In these instances, the pontoon units, without expending their own authorized parks, move forward on the basis of a combat alert signal into the designated areas, lay floating bridges from reserve parks, and then hand them over to the organs of the civil defense to be maintained and used, or to the road repair and traffic control units of the rear services of the front, which are at the disposal of the commandants of the road zones and areas.

In the plan for the movement forward and deployment of the front troops which is drawn up by the headquarters of the border military district already in peacetime, it is desirable to work out in detail the entire organization of river crossings in the depth of the border zone. In the part of this plan which deals with the troop crossing, in our opinion, the following matters should be reflected:

-- the presence, specifications, and condition of permanent bridges on all the large rivers in the zone of the movement forward;

-- the forces and means allocated for air defense, security, maintenance, and operation of the existing bridges;

-- the sites where trestles have been built, and where deep fords and routes for underwater tank crossings have been prepared;

-- the areas for the concentration of pontoon bridge parks, components of wooden low-level bridges, local amphibious river means and other water-crossing equipment allocated for use in the event that permanent bridges are destroyed;

-- the disposition and distribution of forces and means to prepare parallel water crossings, the procedure for transmitting the signal for actions, the crew and their movement forward to the work area;

-- the sites selected for the laying of parallel bridges and construction of alternate crossings, their load-carrying capacity, the time required to achieve readiness, and the forces allocated for the preparation and maintenance of each crossing;

-- the procedure and time limits for the transfer of bridges being prepared by the engineer troops to the units of the rear services and the detachments of the civil defense;

-- the setting up of surveillance over the condition of the bridges and water crossings and the levels of radiation in the areas adjacent to them, the warning of the troops moving forward about the destruction of permanent bridges and the procedure for utilizing parallel and alternate crossings;

-- camouflage measures (dummy bridges, crossings and others), the place, time, forces and means to carry them out;

-- control of the crossing of the troops moving forward, the setting up of traffic regulation, and the road traffic control service on water crossings.

Such a plan will require constant adjustment and refinement with regard to changes in the situation and conditions of troop deployment. It is also necessary to have variants of the plan, taking into consideration the special features of the time of year and the condition of the rivers (periods of flash floods, when rivers are frozen over, and so on).

Besides the needs of the front, in our opinion, the plan should reflect the procedure for providing the civilian population with crossings. Considering the large units and units entering the composition of the front, it obviously will not be possible to occupy all the crossings and bridges for several days just for the one-way troop movement to the state border. Even as early as when there is notification of a threatening situation, the intensive evacuation of the population from large cities will begin. Personnel and equipment will be concentrated in the areas where the military units and facilities are being activated. Rescue and restoration detachments will rush to sites where the aftereffects of enemy nuclear strikes are to be eliminated.

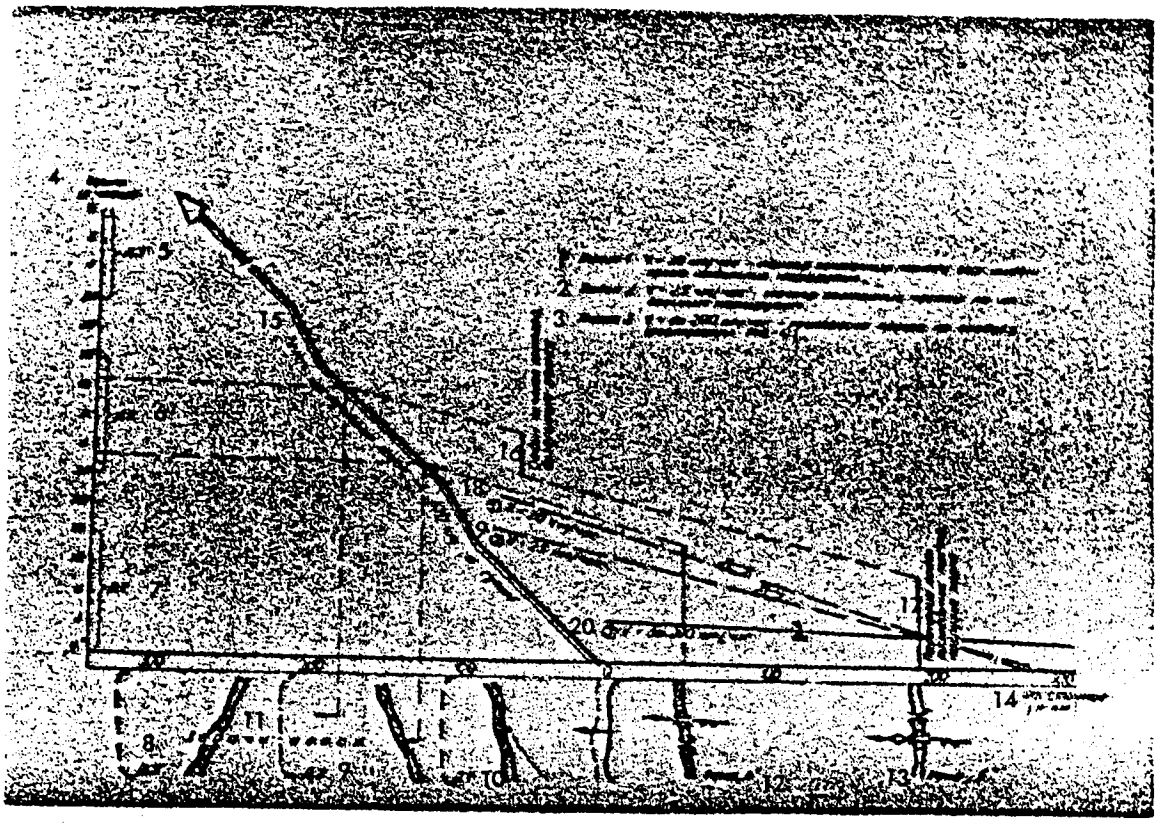
Accordingly, for the entire period of the movement forward and deployment of the front troops it is necessary to allocate specific water crossings for the needs of the civil defense, which on large rivers could be the various ferries and river vessels which operate in peacetime, and on smaller rivers -- the bridges not being used by the troops. On each large river in the border zone, for example, in the Western Theater of Military Operations in the zone of the movement forward of an army having a width of 80 to 100 kilometers along the front, there will be five to six ferries having a total capacity of 10 to 12 thousand tons of cargo (1.5 to 2 thousand motor vehicles) per day. If such a number of crossings does not satisfy the needs of the civil defense in individual areas, then it will be necessary to allocate for specific time limits certain bridges and water crossings which were designated for the troops, according to a plan agreed upon beforehand.

In this manner, the timely movement forward and deloyment of front troops for rapidly going over to the offensive following the initial nuclear strike require that support of troop crossings over numerous water obstacles in the border zone of the theater of military operations under conditions of any sort of destruction by the enemy of the existing bridges and crossings, be thoroughly thought out and carefully organized.

Table of Basic Indices of Various Types of Parallel Crossings

Measures for paralleling crossings	Conditions for carrying out the work	Time		Time required to ready the crossing	Requirement	
		for the loading and delivery of structures	for preparing a crossing		Engineer Forces	Crossing means and transport for carrying structures
Designation and final preparation of a deep ford or path for an underwater tank crossing	The selection of ford (path) and partial preparation of them carried out beforehand	--	30 to 40 min.	2 to 2.5 hours	Diver-reconnaissance or combat engineer detachment	--
Construction of a low-level bridge on pilings	Bridge components stocked up beforehand in a warehouse 5 to 10 kilometers away	1.5 to 2 hours	7 to 8 hours	10 to 12 hours	Bridge building or pontoon bridge battalion	40 to 45 trips using the ZIL-152
Construction of a submerged bridge on pilings	the same	1.5 to 2 hours	16 to 18 hours	19 to 22 hours	the same	the same
Construction of a floating bridge with fixed approach spans (Trestles and floating part - river flotation equipment)	Trestle components (60 to 80 m) and the bridge superstructure are located in a warehouse 5 to 10 km away, barges (afloat) 10 to 15 km away either upstream or downstream	3 to 3.5 hours	6 to 7 hours	11 to 13 hours	Engineer-combat engineer, road or bridge building battalion	25 to 30 trips using the ZIL-152, 14 to 16 barges with a cargo capacity of 200 to 300 tons or more
The laying of a floating bridge from the authorized pontoon bridge park	A previously reconnoitered site for the laying of a bridge, vehicle-mounted parks	--	30 to 40 min.	2 to 2.5 hours	Pontoon bridge battalion	1 pontoon bridge park set
The same for heavy pontoon parks	the same	--	1 to 1.5 hours	2.5 to 3.5 hours	Pontoon bridge regiment	1 heavy pontoon park set

Measures for paralleling crossings	Conditions for carrying out the work	Time		Time required to ready the crossing	Requirement	
		for the loading and delivery of structures	for preparing a crossing		Engineer Forces	Crossing means and transport for carrying structures
The laying of a floating bridge with fixed approach spans from an authorized park using prefabricated trestles	Trestles built in peacetime, vehicle-mounted parks	--	0.5 to 1 hour	2 to 3 hours	Pontoon bridge battalion with a heavy pontoon park or a pontoon company with a pontoon bridge park	1 set of a heavy pontoon park or ½ set pontoon bridge park
The laying of a floating bridge with fixed approach spans from river flotation equipment using prefabricated trestles	River flotation equipment concentrated 10 to 15 km from the site where the bridge is laid	2 to 2.5 hours	4 to 5 hours	7.5 to 9.5 hours	Engineer-combat engineer, road or bridge building company	10 to 12 trips with a ZIL-152, 14 to 16 barges
The laying of a floating bridge from a reserve park	A reserve park deployed on the water in the area where the bridge is laid	--	1 to 1.5 hours	2.5 to 3 hours	Engineer-combat engineer, road, bridge building or pontoon company	--



LEGEND

1. Line 1 - V = 20 km/hr. -- maneuver of pontoon units not allocated separate routes
2. Line 2 - V = 25 km/hr. -- maneuver of pontoon units along separate routes
3. Line 3 - V = up to 200 km/hr. -- dropping of parks by air (MI-6 helicopter)
4. Time (in hours)
5. Day 3
6. Day 2
7. Day 1
8. Day 3
9. Day 2
10. Day 1
11. Tasks of the troops
12. River "A"
13. River "B"
14. Distance (in kilometers)
15. Rate of advance of troops -- 100 kilometers per day
16. Rest for personnel, refueling of vehicles
17. Crossing of troops
    Opening of bridge
    Loading of park
18. V = 20 km/hr.
19. V = 25 km/hr.
20. V - up to 200 km/hr.