REACH-BACK POSSIBILITY - TEMPORARY BRIDGES AFTER FLOODS IN 2013

Martin Benda *)

ABSTRACT
The paper deals about operation of Czech Army Engineer Corps in year 2013. There were three units of Czech Army participate in this operation: University of Defence, Military Geodetical and Hydrometeorological Office and 15 Engineer Brigade. The aim of this operation was to construct temporary bridge after flood. During this operation was used REACH-BACK concept between University of Defence and Geodetical and Hydrometeorological Office and between University of Defence and 15 Engineer Brigade. Communication and cooperation between these units was supported by Information portal of engineer corps. The portal works as a support element for REACH-BACK concept.

Key words:
reach-back, engineer, temporary bridges, TMS and MS bridge type

ABSTRAKT
Článek pojednává o operaci Armády české republiky (AČR), která proběhla v roce 2013. Do této operace byly zapojeny tři součásti AČR. Jednalo se o tyto: Univerzita obrany, Vojenský geodetický a hydrometerologický ústav a 15. Ženijní brigáda. Cílem operace byla výstavba mostních provizorií po povodni. Během této operace byl použit koncept REACH-BACK mezi součástmi zapojenými do operace. Komunikace a spolupráce mezi zapojenými součástmi byla podporována Informačním portálem ženijního vojska, jenž je základním podpůrným prvkem konceptu REACH-BACK.

Klíčová slova:
reach-back, ženijní vojsko, provizorní mosty, TMS a MS mostní soupravy

*) Ing. Martin Benda, Ph.D., Universita obrany, Fakulta vojenskýxh technologií, Kounicova 65, 612 00 Brno, tel.: 973 442 626, e-mail: martin.benda@unob.cz.

1 INTRODUCTION

The Czech Republic territory was hit by floods in June 2013. There were damaged bridges mainly in middle part of part of Czech near the Prague. The engineer experts from University of Defence have essential experience with overcoming the obstacles caused by flood. They designed 20 bridges in the disaster affected areas of the Czech Republic in 2010. The most of them were bridges from MS set but one the longest and the most difficult was bridge from TMS set.

Last year the soldiers from battalions 15 Engineer Brigade erected 4 MS type bridges and soldiers from Bridge Company 151 Engineer Battalion built the bridge TMS. The operation of designing and constructing of temporary bridge TMS took almost 5 weeks (from end of June to start of August).

There were three units of Czech Army participate in this operation - University of Defence (Department of Engineer Technology), Military Geodetical and Hydrometeorological Office, and 15 Engineer Brigade. Every mentioned unit organized particular team or teams that were included in this operation.

REACH-BACK concept was used for the first time as support for so large operation in 2009. Basic principles of the concept demonstrated that it can operate successfully in praxis.

That was the reason why the concept REACH-BACK together with Information Portal of Engineer Corps (IPEC) was used for support during this operation again. It is suitable to introduce the Reach-Back concept at first and explain the main possibility of its usage. It is a new model of cooperation and communication between the units deployed directly in action and main corps supporting them. This concept supposes units used for tasks compliance (for example in foreign mission) and these units do not necessary consist of all components as well as home. The components staying “home” fill tasks for “in theatre” units as their support team [1].

2 TEMPORARY BRIDGING SETS MS AND TMS

As a suitable temporary bridge for over bridging four gaps was chosen MS bridge set. Only one bridge was replaced by TMS set because of higher carrying capacity requirement. There were damaged bridges of short span mainly. That is why most of them were replaced by temporary bridge MS type. The longest MS type bridge in Nový Knín village had span 24 m, but for launching was used longer construction (27 meter). The requirements of civilian authority for carrying capacity were the next reason. The most of them needed carrying capacity up to 20 ton. Temporary bridge from TMS set was built up in Chlum u Sedlčan village and was only 15m long.

Bridging set MS ant TMS are standardized portable steel bridges with two primary truss and lower bridge deck. It is used only for one-way traffic lane with maximum carrying capacity 60 ton. It is the most suitable to build one span bridge

with length 21 m (carrying capacity 60 t) for MS type and one span bridge with length 36m (carrying capacity 70 t) for TMS type [2], [3]. It is possible to build a bridge with longer span but the carrying capacity must be reduced.

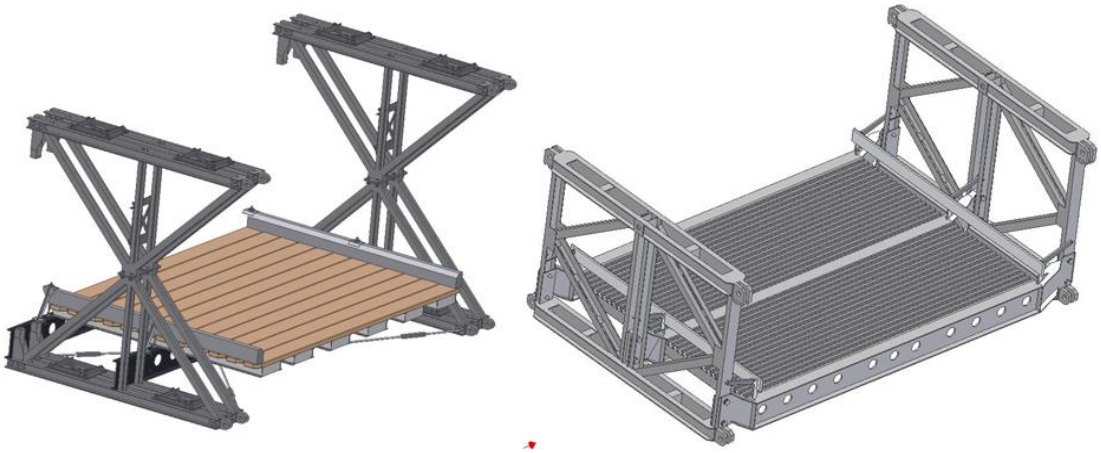

Figure 1: Model of bay TMS and MS bridge set created by Autodesk Inventor SW

When using pier (e.g. PIŽMO), it is possible to build also bridges with more spans. The 3m long bay is the basic assembly element for both sets (Fig. 1). It is possible do assemblage for both sets by the help of plain rollers, rocking rollers, and cantilever. The other alternative is to assemble the bridge on flat ground and put it over the obstacle by a suitable crane. The main advantage of MS type is that it is not necessary to do special modification of banks for placing the bridge and ramp. The ramp is created by folding ramps which belong to the end bridge bay. TMS type need complex ground shaping not only for placing but also for construction. The ramp for TMS must be done by special ramp or abutment wall (Fig. 2).

Both these bridge sets are not equipment of Czech Army. These bridge sets are in storage of Ministry of Transport. The soldiers of Engineer Corps are trained in special courses in Training centre of Ministry of Transport, where they get the experience with this bridge construction and also with other bridge constructions.

Figure 2: Assembling of the bridges

3 RECONNAISSANCE AND GEODETIC SURVEING

The main task for reconnaissance team (reco-team) was the reconnaissance of area where the bridge was planned to be built. This team consists of experts from Military Geodetical and Hydrometeorological Office from Dobruška and one member from Department of Engineer Technology who has experience with TMS and MS sets. This team configuration is possible to use for future similar tasks.

Geodesists were responsible for geodetically survey of the construction site of temporary bridge. The reco-team carried out inspection of the construction site and made photo documentation. They found out span of the obstacle and suggested which type of bridge is suitable for particular gap. All information was included in Reconnaissance Report. When the reco-team accomplished the report, they placed it on IPEC. The geodesists were lead by commander of the reco-team and under his control they made detailed geodetically survey. The data gained from survey were essential part of the Reconnaissance Report and were attached to the report as soon as geodesists prepared them. The data consisted of coordinates of important points and construction site drawing in MicroStation software. The data were used for preparation of every project of temporary bridge.

4 PROJECT OF TEMPORARY BRIDGE

The project team was put together first of all. The five-member project team was from Department of Engineer Technology at University of Defence. Two members of the team worked with geodesists as members of the reco-team and other two members designed projects. Last member was leader of the team who was responsible for communication with civilian authorities. The project team used experience from regularly practised actions in collaboration with Dobruška Military Geographic and Hydro-Meteorological Office. They improved their skills and cooperation that they gathered in 2009 and 2010 during similar operation [4]. The project team repeatedly proved that the involvement of university Reach-Back laboratory in "life operation" brings good results, making the collaboration with the geodesists from Dobruška and 15th Engineer Brigade personnel smooth and easier.

Project team took data (photos, video and geodetic surveying) and Reconnaissance Report that was on IPEC server and started work on project. They also implement suggestion of reco – team that would be suitable to use TMS bridge for this situation. The project team had to accept the requirements of civilian authorities. They had two particular requirements. The first one was that the construction of the bridge had to be above 50 years flood water level. That is why the lower chord of the truss was placed approximately 1,2 m above terrain. The second was that construction had to be easily attached to existing road on the both sites of the banks.

The leader of project team specified type of construction, site for construction and span of the bridge. Team created 3D model of bridge construction (Fig. 3).

This 3D model was also used for making project documentation. Designing necessary ground shaping in area of construction was other part of project. Microstation situation data were converted into proper CAD format. Then team created into terrain ground shaping and other modification. Then the 3D model of bridge was placed into model of terrain.

Sometime it was very suitable placed model of bridge into photo. It made placing bridge construction in real situation more illustrated. The last part of designing was creating the final project and drawing documentation.

Figure 3: Model of bridge placed in photo

The final project with drawing was placed on server IPEC. Then Request to prepare bridge and assembly material from store houses of Ministry of Transport was created. The Request to prepare was sent to responsible person to Ministry of Transport by the help IPEC. They prepared entire material necessary for bridge construction in the nearest store.

5 CONSTRUCTION OF BRIDGES

As was mentioned above there were erected four bridges from MS set but only one from TMS set. Since TMS bridge construction is more complicated then MS type, commander of 151 Engineer Battalion was tasked to organize the construction of the bridge. Soldiers from this unit have the best experience with this type of construction and some of their commanders work as instructors in Ministry of Transport´s courses for construction TMS bridge in Kojetín training centre. The commander of building unit read up the project and made eventually consultation with the project team with the help of web conference on IPEC.

Tab. 1 – Time table of construction process

Date	Location and type of the bridge
25.7.2013	Červený Hrádek MS – 24m
26.7.2013	Chlum u Sedlčan TMS – 15m
10.-11.7.2013	Nový Knín MS -24m
27.7.2013	Velké Číčovice MS – 15m
30.7.2013	Zadní Třebáň MS – 18m

At the first of all it was necessary to prepare building site. The commander of each building unit made meeting with local civilian authority and explain them his requirements (e.g. cut off power line, get down trees or remove fence). The requirements came from project and other commanders drafts (Fig. 4). When whole the building site was prepared the commander sent unit to pick up the material of bridge set from the store house and to transport it into building site.

The commander started building of the bridge after the unit with bridge construction came into building site. The first step was to construct the rocking rollers and plain rollers trays. The rocking rollers were placed on concrete panels. The grillage from the timber was often used. The short ramp and concrete panel were used as foundation for the grillage (Fig. 2). When the plain rollers trays were assembled the launching nose were erected on rollers. When the assemblage of the nose was complete, assemblage the first bay of the bridge followed. Then the next bays of the bridge were assembled by the same way except the end bay. When the complete construction of the bridge was launched the jack down procedure started. The most of units were equipped with hydraulic jacks with load capacity 50 tons. Unfortunately, neither of them was able to work. Jacks were from the storage of Ministry of Transport and we identified that their future using is impossible due to the life span of them. The jacks had to be replaced by the jack from vehicle accessories. These jacks had load capacity only 20 tons but it was sufficient in this case.

Load test by using car crane was the last task and then the commander made inspection of the bridge construction. The whole building process of one bridge (from picking it up from the store house to giving into traffic) took one or two day. There is not included the time that was necessary for ground shaping. The building process of TMS bridge took approximately four days because of the type and span of the bridge.

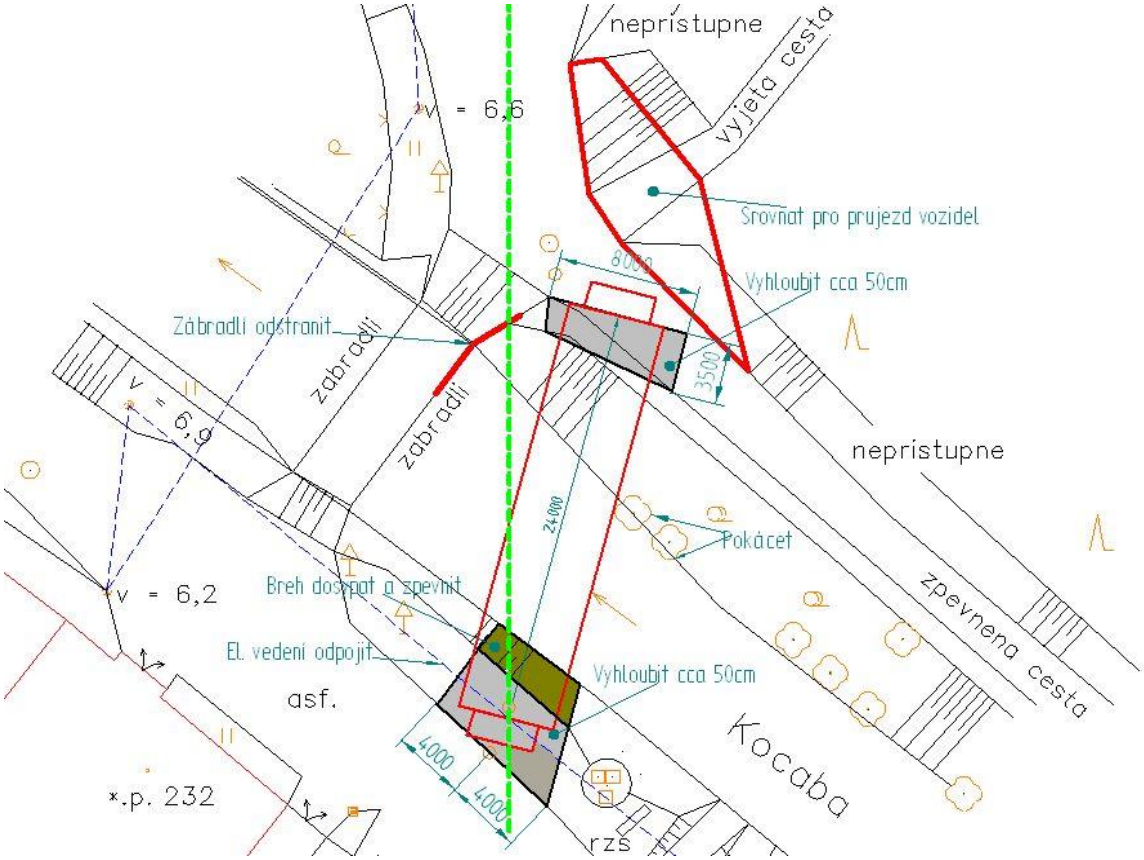

Figure 4: Requirements for preparing the building site

6 CONCLUSION

The range of transport infrastructure recovery by using temporary bridge was less extensive than in 2009 and 2010. All units involved in the operation "building temporary bridges" learned from the mistakes committed in last years and have made considerable progress. This progress was reached mainly in the area of MS type construction. On the other hand, we have found that there are many problems that we have to cope with in the future. Some of them persisted from past. For example problems in communication between units which participate in construction of the bridge and Ministry of Transport. It was caused by the fact, that in our army there still exist units that have very rare access to internet. The problem that persisted from the past is that units are not equipped by timber that is in many cases very useful. Many soldiers participated in "live" action in 2009 and 2010 and they got valuable experience, in spite of the fact that they did not take part specialized course.

A significant progress was achieved in area of designing temporary constructions due to modern software tools [4]. The communication and data transmission between University of Defence and Military Geodetical and Hydrometeorological Office is on high level quality. It is due to periodical practise between these two units. It will be necessary also to determine the command and control responsibilities and to divide them between civilian and military authorities in the future [5].

REFERENCES

[1] MAŇAS, P. - MAZAL, J.: The Reach-Back Concept in The Czech Army Corps of Engineers. In: International Conference on Military Technologies. Brno: Faculty of Military Technology, University of Defence, 2009. ISBN 978-80-7231-648-9.

[2] MAŇAS, P. - SOUŠEK, R. - BENDA, M a kol.: Stavba provizorních mostů ze soupravy MS. Brno: Institut Jana Pernera, o.p.s., 2010, ISBN 978-80-86530-73-4.

[3] MAŇAS, P. - SOUŠEK, R. - BENDA, M a kol.: Stavba provizorních mostů ze soupravy TMS. Brno: Institut Jana Pernera, o.p.s., 2010, ISBN 978-80-86530-74-1.

[4] SOBOTKA, J.: Comparison of elevation data of the Czech Republic for designing military constructions. In: Advances in Military Technology, 2013, vol. 7, no. 2, p. 57-63. ISSN 1802-2308.

[5] MAŇAS, P. - SOUŠEK, R.: On Cooperation between Military and Civilian Authorities in the Czech Republic during Crisis Situation in Transport. In International Conference on Engineering and Meta-Engineering icEME 2010. Orlando, Florida, USA : IIIS, International Institute of Informatics and Systemics, 2010, p. 12-14. ISBN 978-1-934272-83-1.

Článok recenzovali dvaja nezávislí recenzenti.