გიორგი მემმარიაშვილი

48 მეტრი მალის მქონე, გასაშლელი საიერიშო ხიდი, მისი ტრანსპორტირების და მონტაჟის ხიდგამდებები

წარმოდგენილია დოქტორის აკადემიური ხარისხის
მოსაპოვებლად

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საქართველოს ტექნიკური უნივერსიტეტი

სამშენებლო fakulteti

ჩვენ, ქვემორე ხელისმომწერნი ვადასტურებთ, რომ გავეცანით გიორგი მეძმარიაშვილის მიერ შესრულებულ სადისერტაციო ნაშრომს დასახელებით: ‘‘48 მეტრი მალის მქონე, გასაშლელი საიერიშო ხიდი, მისი ტრანსპორტირების და მონტაჟის ხიდგამდებები” და რეკომენდაციას ვაძლევთ საქართველოს ტექნიკური უნივერსიტეტის სამშენებლო ფაკულტეტის სადისერტაციო საბჭოში მის განხილვას დოქტორის აკადემიური ხარისხის მოსაპოვებლად.

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სხდომა ჩატარდა:

ინდივიდუალური პიროვნებების ან ინსტიტუტების მიერ ზემოთმოყვანილი დასახელების დისერტაციის გაცნობის მიზნით მოთხოვნის შემთხვევაში მისი არაკომერციული მიზნებით კოპირებისა და გავრცელების უფლება მინიჭებული აქვს საქართველოს ტექნიკურ უნივერსიტეტს.

ავტორის ხელმოწერა

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რეზიუმე

sainJinro uzrunvelyofis mniSvnelovan faqtors warmoadgens gadasalax winaaRmdegobebze samxedri xidebis ageba, romlebic, Tavisi funqciebidan gamomdinare, aris sami saxis: droebiTi xidebi, romlebic igebian sakomunikacio zonaSi; sajariso nawilebis moZraobis marSrutebze Seqmnili, swrafadasagebi, egrT wodebuli gamyoli Tu gamcilebeli xidebi; da, uSualod sabrZolo viTarebebSi gamosayenebeli, swrafadasagebi, gasaSleli meqanizebuli xidebi, romlebic didi warmatebiT SeiZleba gamoyenebul iqnas samoqalaqo miznebisaTvis eqstremalur situaciebSi da sagangebo viTarebebSi.

warmodgenili samuSao Seexeba metad aqtualur problemas. arsebul saieriSo xidebTan da maT xidgamdebebTan SedarebiT, romlebic Tanamedrove etapze iZlevian saSualebas erT satransporto_samontaJo saSualebaze – xidgamdebze ganTavsebuli, maqsimum 12÷16 metris sigrZis mqone dakecili paketiT, dajavSnuli tankidan ekipaJis gadmousvlelad 3_7 wuTSi gadon xidi dabrkolebaze, romelTa sigane Seadgens 22÷30 metrs, Seiqmnas ufro didi 32÷48 metri malis mqone gasaSleli meqanizebuli xidebi da maTi xidgamdebi.

aRniSnuli amocana, warmodgenil naSromSi, miiRweva etapobrivad, transformirebadi sistemebis Teoriis gamoyenebiT, romelsac safuZvlad udevs gaSla_dakecviT formaTwamoqmnis ormagi da sammagi tipis transformaciebi, nacvlad arsebul saieriSo xidebSi relizebuli erTi tipis transformaciebisa, miuxedavad imisa Tu romeli – “wamocmis” Tu “gadabrunebis” meTodiT xdeba maTi gadeba dabrkolebaze.

aseTi logikiT pirvel etapze ganxilulia saieriSo xidebi, romelic ori tipis transformacia udevs safuZvlad.

gasaSleli xidi, romlis konstruqcia agebulia transformirebadi sistemebis “dakecvis princips”+”teleskopis principiT” formaTwarmoqmnis principebiT, xasiaTdeba transformaciis maRali xarisxiT. igi saSualebas iZleva dakecil satransporto paketidan, romlis gabaritebi Seesabameba arsebuli samxedro xidebis dakecil gabaritebs da wonas, gaSlis safuZvelze miRebul iqna 48 metri sigrZis xidi.

amasTan, aRniSnul xidebs gaaCnia mravali cilindruli kvanZebi, rac sabrZolo viTarebebSi garkveuli naklovanebebis matarebelia, da amasTan misi sixiste Runvisadmi xidis grZivi mimarTulebiT aris SedarebiT dabali, rac mis mniSvnelovan nakls warmoadgens.

amdenad, Semdgom etapze daisva amocana, Seqmniliyo gasaSleli xidi, romlis ZiriTadi mzidi elementebi, romlebic maRali sixistis arian, gaSlis etapze asruleben sistemis transformaciis ZiriTadi meqanizmebis funqcias, xolo xidis transformaciis bolo etapze, rodesac xdeba transformirebadi sistemis fiqsirebuli saeqspluatacio formis miReba, aRniSnuli elementebi ukve gvevlinebian xidis zeda savali nawilis da sartyelis mzid elementebad.

am moTxovnebiT Seiqmna gasaSleli xidis konstruqcia, agebuli transformirebadi sistemis formaTwarmoqmnis |dakecvis princips” + “daxvevis principiT”. samuSaoSi ganxilulia xidis konstruqciis ZiriTadi sqemebi, misi gaangariSeba da Seqmnili 4,8 metri sigrZis modelis eqsperimentuli kvleva.

Sesrulebulma kompleqsurma kvlevebma warmoaCina xidis dadebiTi Tvisebebi, rac aRniSnuli xidis Seqmnis mecnierebatevadobiT da teqnologiurobiT aris ganpirobebuli. amasTan, gazrdili malis SemTxvevaSi, daaxloebiT 38m÷48m diapazonSi, izrdeba xidis dakecili satransporto paketis simaRle, rac garkveul farglebSi zRudavs xidgamdebis mobilurobas. xidgamdebis konstruqcia, romelic tankis bazazea Semnili, xasiaTdeba samintaJo isris didi simaRliT, rac xidis SeniRbvas uSlis xels da

bolos garTulda awyobis sqema xidis qveda, dasaxvevi, maRali simtkicis bagirebisagan Seqmnili sartyelis.

xidis modifikaciaSi, romelic agebulia “dakecvis princips” + “dakecvis principiT’, bevri uaryofiTi Tviseba aRmoifxvra, magram gasaSleli xidis dakecili paketis simaRle kvlav maRali darCa.

aRniSnuli, sarekordo sigrZis malis xidebi, romlebic sistemurad, Tanmimdevruli logikiT Seiqmna Tavisi yvela parametrebiT mTlianad akmayofileben maTi samoqalaqo gamoyenebis moTxovnebs. samuSaoSi sakiTxi Seexeba mxolod da mxolod forsirebis operaciebSi xidebis da xidgamdebebis gamoyenebas, rac TavisTavad samxedro xelovnebaSi urTules procedurad aris miCneuli da igi TviT xidgamdebisagan da xidisagan ganskuTrebuli parametrebis dakmayofilebas moiTxovs. am mizniT, ormagi transformaciis principebidan, gasaSleli xidebis formaTwarmoqmnisaTvis sammagi transformaciis principze gadasvla gaxda saWiro, amasTan axali xidgamdebis Seqmnis mizniT gamoyenebul iqna sammagi transformaciis principze Seqmnili gasaSleli xidis gadasalax winaaRmdegobaze xidgamdebis mier kompleqsuri meTodi _ “wamocmis meTods” + “gadabrunebis meTodiT” gadeba.

aRniSnuli transformaciis principebis da xidgamdebis mier xidis dabrkolebaze gadebis kompleqsuri meTodis klasificirebiT da sistematizaciiT damuSavda sabazo varianti saieriSo, gasaSleli, meqanizebuli xidgamdebis da xidisa maliT 32÷48 m. xidis sruliad gansxvavebuli konematikuri sqema, misi realizaciisaTvis moiTxovs aseve ori tipis sakvanZo kompleqsis gamoyenebas, rac arsebul Tanamedrove xidebis konstruqciebSi ukve gadawyvetilia da gamoyenebuli, rac xidis sqemis kinetikis dadebiTi Tvisebaa, radganac amiT kidev ufro azrdeba sabazo xidis damzadebis teqnologiuroba.

Seqmnili xidi damzadebulia maRali simtkicis aluminis Senadnobisagan. misi dakecili satransporto paketis gabaritebia: sigane 4,1 m; sigrZe 12 m.; xolo simaRle Seadgens 2,6 metrs, rac metad mniSvnelovania. xidis mali jer iyofa SuaSi da urTierTSemobrunebiT ikeceba. dakecvis dros xdeba xidis ori nawilis erTmaneTSi Sesvla, Semdeg ki, malis ganapira nawilebis gadaadgilebiT xidis satransporto paketi aRwevs Tavis minimalur zomebs. gansxvavebulia da optimaluri xidgamdebis sqema, romelic Seqmnilia tank “leopard_2”-is bazaze. tankidan xidis montaJi xorcieldeba xidis win wamweviT, Semdeg xidgamdebis baqnis gruntze dayrdnobiT da xidis konsolurad montaJiT. procesi iTvaliswinebs yvela SesaZlo datvirTvebs da xidgamdebis fiqsacias, amoyiravebis sawinaaRmdegod. xidis wona Seadgens 19,5 tonas.

SemoTavazebuli xidis transportireba da montaJi aseve SesaZlebelis avtomobilidan da vertmfrenidan, rac metad mniSvnelovania sabazo xidis samoqalaqo miznebiT gamoyenebisaTvis da amasTan vertmfreniT saieriSo xidebis montaJi, sruliad Seesabameba samxedro xelovnebis Tanamedrove moTxovnebs.

Abstract

Important factor of engineering provision is building military bridges over obstacles, the bridges being of three types according to their functions: temporary bridges being built in communication zones; rapidly layable, the so called escort bridges implemented on troops displacement routs; and rapidly layable deployable mechanical bridges directly usable in military situations that can very successfully be used in civil conditions, extreme situations and in emergency circumstances alike.

The present work touches upon a topical problem – to develop deployable mechanized bridges of a bigger span of 32÷48 meters and their bridgelayer in comparison with conventional assault bridges and their bridgelayers which enable to lay a bridge over an obstacle of 22÷30 meters in width in 3-7 minutes by means of a stowed package of 12÷16 meters in length that is placed on a single vehicular means – bridgelayer, without the crew having to exit the armored tank

The mentioned task can be fulfilled with staged approach, with the application of transformable systems theory based on double and triple type transformations of shaping by deployment-folding, instead of a single type transformations realized in conventional assault bridges, no matter what method is used for laying them over an obstacle - whether it is "putting on" or "inverting".

At the first stage, assault bridges based on two types of transformation are considered at the initial stage.

The deployable bridge construction based on the "folding principle"+"telescope principle" of shaping is characterized by high quality. It enables to assume a 48 meters bridge by deploying the folded transport package of which sizes correspond to the sizes of existing folded military bridges.

Besides, the mentioned bridges have multiple cylindrical units, that is disadvantageous in battle situations, and their stiffness against bending is relatively low in longitudinal direction, which can be regarded as serious drawback as well.

Thus at the further stage, a task of developing a deployable bridge that would have high stiffness load-bearing elements playing a role of main mechanisms of the system transformation at the deployment stage was set, where the elements would have to be load-bearing ones of the upper running part and chord of the bridge at the final stage of transformation when a fixed operation shape of the transformable system is assumed.

Based on these requirements, a deployable bridge construction by application of "folding"+"rolling" approach of shaping has been developed. The work overviews general designs of the bridge, its calculation and experimental study of the developed model of 4.8 meters in length.

The conducted complex studies revealed advantages of the bridge, conditioned by high-end technology of the bridge development. It should be noted that in case of enlarged span, approximately within the range of 38m÷48m, the height of the stowed transport package of the bridge increases, which leads to limiting the bridgelayer transportability. The bridgelayer construction that is developed on the tank basis is characterized by considerable height of mounting, which hampers the bridge to be blanked off, and the assembling of the lower rollable chord made of high stiffness cables became difficult.

In the modification of the bridge which is built on the base of "folding principle"+"folding principle", many disadvantages were eliminated but the stowed transport package of the bridge still remained high.

The mentioned record-breaking length span bridges developed by systematic, step by step approach, completely fulfill the requirements of civil application by all their parameters. The work deals with the use of bridges and bridgelayers in forced operations only, which is regarded as an extremely difficult procedure in the military art and requires from a bridge and bridgelayer fulfilling special parameters. To this end, it was necessary to use the triple transformation approach for shaping instead of the double transformation approach, and a complex method - **"**putting on method" + "inverting method" of laying a deployable bridge developed by triple transformation approach over an obstacle was used for the purposes of developing the new bridgelayer.

By application of the mentioned transformation approaches and by classifying and systematizing the complex method of laying the bridge over an obstacle by a bridgelayer, basic modifications of a deployable mechanized assault bridgelayer and a 32÷48 m. span bridge were developed. The completely different kinematical design of the bridge requires use of two types of key complexes that are already used in modern bridge constructions, which is the advantage of the bridge kinetics due to the fact that manufacturability of the basic bridge is improved even more.

The developed bridge is manufactured by high stiffness aluminum alloy. The sizes of its stowed transport package are: width 4.1 m; length 12 m; and height is 2.6 which is very important. The bridge span is divided in the middle initially and then it is folded by mutually turning. When it is folded, the two parts of the bridge enter each other, and then, by displacement of the span edge parts, the bridge transport package attains its least sizes. The bridgelayer design which has been developed on the basis of the tank LEOPARD-2 is unusual and optimal. The bridge is mounted from a tank by displacing it ahead and then by resting the bridgelayer platform upon the ground and mounting the bridge in cantilever fashion. The process envisages all possible loads and fixing the bridge against overturning. The bridge weight is 19,5 tonnes.

The bridge can be transported and mounted also by a motorcar and helicopter which is very important in terms of use the basic bridge for civil purposes, and the mounting of assault bridges by a helicopter completely corresponds to the modern requirements of the military art.

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samxedro-sainJinro dargi farTod moicavs saxelmwifos sainJinro momzadebas TavdacvisaTvis da brZolebisa da operaciebis sainJinro uzrunvelyofas [1].

samxedro-sainJinro dargi ZiriTadad ganixilavs Semdeg mimarTulebebs:

— sakuTari ZalebisaTvis da mosaxleobisaTvis mobilurobis Seqmnis sainJinro uzrunvelyofa;
— mowinaaRmdegis Zalebis maqsimaluri Seferxebis da dabrkolebebis sainJinro uzrunvelyofa;
— sakuTari Zalebis, teqnikisa da obieqtebisaTvis sicocxlis-unarianobos SenarCunebisaTvis sainJinro RonisZiebebis uzrunvelyofa;
— zogadi inJineria;
— topografiuli inJineria.

aRniSnuli procedurebis kvleva da maTi gamoyenebis meTodebis da xelovnebis dadgena xorcieldeba samxedro-sainJinro mecnierebis farglebSi.

samxedro-sainJinro xelovnebis Teoriuli safuZvlebis praqtikuli gamoyeneba wydeba operatiul-strategiuli, operatiul da taqtikur doneebze.

operatiul-strategiul doneze, xorcieldeba saomari moqmedebebis Teatris da saxelmwifos samxedro-sainJinro momzadeba TavdacvisaTvis – omisaTvis. operatiul da taqtikur doneebze xorcieldeba brZolebis, operaciebis da sabrZolo moqmedebebis sainJinro uzrunvelyofa.

mSvidobianobis, omis samzadisis da gansakuTrebiT brZolebisa da operaciebis sainJinro uzrunvelyofis dros, gansakuTrebulad mniSvnelovania sainJinro viTarebis Seswavla.

sainJinro viTareba, im faqtorebisa da pirobebis erTobliobaa, romlebic axasiaTeben adgilmdebareobas da mis sainJinro mowyobas, mowinaaRmdegisa da sakuTari sainJinro jarebis mdgomareobas da SesaZleblobebs, sxva jarebis, Zalebisa da saSualebebis SesaZleblobebs da moqmedebebs sainJinro uzrunvelyofis amocanebis Sesasruleblad.

teritoriis sainJinro Seswavlis Semdeg, rac gamoavlens sainJinro viTarebas, iwyeba sainJinro uzrunvelyofa.

sainJinro uzrunvelyofa aris operatiuli uzrunvelyofis saxeoba da im sainJinro RonisZiebebisa da amocanebis kompleqsi, romelic sruldeba jarebisaTvis xelSemwyobi pirobebis Sesaqmnelad, maTi drouli da faruli win wawevis, gaSlis manevrisa da sabrZolo amocanebis Sesrulebis, dazianebis sxvadasxva saSualebebisagan dacvis amaRlebisaTvis, agreTve, mowinaaRmdegisaTvis danakargis miyenebisa da misi moqmedebebis gaZnelebisaTvis.

sainJinro uzrunvelyofis erT-erTi umTavresi proceduraa adgilmdebareobis swori mowyoba, romelSic gansakuTrebuli adgili ukavia samxedro infrastruqturis mowesrigebas da Seqmnas. igi aris qveynis saomari moqmedebebis Teatris stacionaruli da arastacionaruli obieqtebis sistema jarebis ganlagebis, swavlebis, gaSlis uzrunvelyofis da operaciebis, sabrZolo moqmedebebis warmoebisaTvis.

stacionaruli da arastacionaruli obieqtebis udides nawils warmoadgens sainJinro nagebobebi, romlis aqtualuri komponentia samxedro xidebi, romlebic iqmneba dabrkolebebis gadasalaxad.

taqtikuri daniSnulebisa an sabrZolo gamoyenebis pirobebidan gamomdinare ganasxvaveben samxedro xidebis Semdeg saxeobebs:

— uSualod brZolis velze asagebi, egreT wodebuli - “saieriSo” xidebi, romelTac gaaCniaT mkacrad SezRuduli dro dabrkolebaze gadebisa da igi Tanamedrove taqtikuri da operatiuli moTxovnebiT Seadgens 3 _ maqsimum 10 wuTs [2].
— sajariso SenaerTebis marSrutze asagebi, egreT wodebuli – “gamcilebeli” an “gamyoli” xidebi, romelTa agebis dro, magaliTad 48-metriani sigrZis xidisaTvis – 30÷90 wuTs Seadgens.
— sakomunikacio zonaSi ganTavsebuli, egreT wodebuli – “zurgis” xidebi, romelTa daCqarebuli agebis dro SezRuduli TiTqmis ar aris.

amasTan, “saieriSo” xidebi, romlebic rogorc Setevis, aseve ukandaxevis dros forsirebis operaciebSi Rebuloben monawileobas, rodesac xidze xorcieldeba sacecxle zemoqmedeba, gadasalax dabrkolebaze aigebian erTi satransporto-samontaJo

saSualebiT – tankiT da xidgamdebis ekipaJis javSanteqnikidan gadmosvlis gareSe. Tanamedrove samxedro “saieriSo” meqanizebuli xidebi, rogorc wesi, arian erTmaliani da maTi sigrZe gaSlil mdgomareobaSi Seadgens 24 _ maqsimum 32 metrs, xolo dakecil mdgomareobaSi igi ganTavsebulia satanko xidgamdebze da misi sigrZe Seadgens 12_13,5 _ maqsimum 16 metrs.

amdenad, gansakuTrebuli taqtikuri da operatiuli mniSvneloba aqvs “saieriSo” xidebis malis gazrdas 32÷48 metris farglebSi, rac samxedro xidmSeneblobaSi aqtualuri problemaa.

mniSvnelovania da bolo periodSi gansakuTrebiT aqtualuria gasaSleli didi sigrZis malis mqone “saieriSo”, meqanizebuli xidebis gamoyeneba samoqalaqo miznebisaTvis eqstremalur situaciebSi da sagangebo viTarebebSi.

saqarTvelosaTvis gasaSleli gazrdilmaliani “saieriSo” xidebis Seqmna, romelTac analogi ar gaaCniaT, mniSvnelovania ara marto sakuTari samxedro da samoqalaqo miznebis misaRwevad, aramed misi komercializaciis pirobebSi saqarTvelo xdeba konkurentunariani, mecnierebatevadi da maRalteqnologiuri samxedro-sainJinro teqnikis realizatori samxedro teqnikis saerTaSoriso bazarze.

amdenad, miznad iqna dasaxuli 32÷48 metri malis mqone “saieriSo” xidis da misi transportirebisa da montaJis dajavSnuli manqanis – satanko xidgamdebis Seqmna, romelic Semdeg moTxovnebs unda akmayofilebdes:

— gasaSleli, meqanizebuli xidi unda iyos erTmaliani;
— gasaSleli xidis dakecili paketi, romelic ganTavsebulia xidgamdebze, unda akmayofilebdes paketis zRvrul, transportirebisaTvis dasaSveb moTxovnebs da aseve satanko xidgamdebis mzidunarianobis Sesabamisi wonac unda gaaCndes;
— xidgadebis procesi unda ganxorcieldes umoklesi drois intervalSi 3÷10 wuTSi, amasTan igi unda iyos teqnologiuri, stabiluri, kontrolirebadi da marTvadi;
— xidgadebis da, asveve, xidis dabrkolebidan aRebis procesi unda ganxorcieldes gadasalaxi dabrkolebis orive napiridan mxolod xidgamdebiT da misi ekipaJis tankidan gadmousvlelad;
— xids unda gaaCndes saTanado saeqsploatacio pirobebi da parametrebi;
— xidi unda iyos daculi sasargeblo tvirTis uaryofiTi zemoqmedebisagan da naklebad dazianebadi sacecxle zemoqmedebiT;
— sacecxle zemoqmedebis Sedegad, xidis dazianebis SemTxvevaSi, igi umetes wilad unda iZleodes saSualebas xidgamdebiT misi garkveuli formiT akecvisa da satanko xidgamdebiT brZolis velidan gatanisa;

— gasaSleli xidi unda iyos mravaljeradi gamoyenebis.

aseTi kompleqsuri miznis miRweva SesaZlebeli gaxda dasmuli amocanis gadawyvetisaTvis mecnieruli siaxleebis damuSavebiT, rac SemdegSi mdgomareobs:

— naSromSi SemoTavazebulia gansxvavebuli sistema gasaSleli xidebis mier formis miRwevisa, romelic efuZneba sainJinro transformirebadi sistemebis formaTwarmoqmnis Teorias;
— naSromSi SemoTavazebulia klasi axali gasaSleli xidebisa, romelTa formaTwarmoqmna ganpirobebulia SeTavsebuli, ormagi da sammagi transformaciis principiT, maSin rodesac SemoTavazebuli meTodiT dgindeba, rom arsebuli gasaSleli xidebi efuZneba transformaciis erT romelime princips;
— transformaciis rTuli – SeTavsebadi principiT Seqmnili gasaSleli xidebis sqemebis mixedviT, konstruirebis logikis safuZvelze damuSavda xidebisa da xidgamdebebis konkretuli gadawyvetebi;
— Seiqmna gasaSleli xidis sabazo struqtura sammagi transformaciis principiT da xidgadebis ormagi principis SeTavsebiT da sinTezuri struqturis teqnikuri da teqnologiuri gadawyvetiT, ramac mTlianad uzrunvelyo xidisa da xidgamdebisaTvis dasaxuli parametrebis srulad dakmayofileba.
— Catarda eqsperimentuli kvelevebi, sadac, aseve Teoriuli da eqsperimentebis Sedegebis monacvleobiT, xidis modelis struqturis formaTwarmoqmnis da gansakuTrebiT formis fiqsaciis sistema damuSavda;
— Seqmnili gasaSleli xidebisaTvis miRweulia saangariSo sqemebis modelebis Seqmna, romelic Seesabameba sistemis daZabul_deformirebul suraTs transformaciis formaTwarmoqmnis yvela etapze – dakecili satransporto paketidan dawyebuli, sistemis gaSlis procesis da formis saboloo fiqsaciis etapis CaTvliT.

SemoTavazebuli mecnieruli siaxleebi dafuZnebulia transformirebadi sainJinro sistemebis Teoriaze, konstruirebis logikaze, gaangariSebis Tanamedrove programul uzrunvelyofaze, romelSic maTematikuri modeli saangariSo sistemisa sasrul elementTa principiT aris Sesrulebuli da Teoriuli Sedegebis eqsperimentuli kvlevebiT dasabuTebaze.

miRebuli Sedegebis praqtikuli gamoyeneba SesaZlebelia xidmSeneblobaSi – swrafadasagebi, gasaSleli xidebis saxiT, romlebic arian transportirebadi da mravaljeradi gamoyenebis.

I. gasaSleli xidebis formaTwarmoqmnis axali sistematizacia da ormagi transformaciis sqemebze gadasvla.

I. 1. transformirebadi sistemebis formaTwarmoqmnis ZiriTadi sqemebi.

meqanizebuli xidebis agebis ZiriTadi procesis gaSla-dakecvis analizi mravalmxrivad Catarebuli da aseve literaturaSi saTanadod Sefasebulia. magram, Tu davisaxavT miznad gazrdili malis mqone, axali saieriSo xidis Seqmnas, maSin kompleqsuri amocanis gadawyveta aucilebeli xdeba.

pirvel rigSi, saWiroa Zieba axali konstruqciuli masalebisa, romelTa eqnebaT didi saaingariSo winaRoba da aseve maRali drekadobis modeli.

aseT masalebad dRes ganixileba minaplasti, naxSirplasti da sxva kompoziciuri da polimeruli masalebi. am mxriv, mravali kvlevebia Catarebuli, romelTa nawilobriv asaxva hpova gasaSleli xidebis calkeul elementebSi da mTlianad konstruqciebSi [3] [4] [5].

axali masalebis erT-erT damaxasiaTebeli niSniT unda iyos misTvis formis miniWebis maRali teqnologiuroba da maTi gamoyenebiT miRweuli ekonomiuri efeqti.

meore rigSi aucilebelia TviT struqturuli analizis safuZvelze, gasaSleli xidebis mzidi da savali nawilebis Sesrulebis konstruqciuli saxecvlileba an maTi gaumjobeseba.

es RonisZiebac miznad unda isaxavdes xidis konstruqciis sakuTari wonis Semcirebas da misi damzadebisas elementebis fragmentebis da calkeuli konstruqciuli kvanZebis damzadebis teqnologiuri pricesebis gamartivebas [6] [7].

magram, kompleqsuri amocanis gadawyvetaSi, xidis malis gazrdis da misi dakecili satransporto paketisaTvis dasaSvebi gabaritebis SenarCunebis mxriv wina planze gadmodis xidis transformaciis procesiT formaTwarmoqmnis axali sqemebis Seqmnis aucilebloba _ xidis gaSla_dakecvis axali speqtriT warmoCena.

aseTi logikiT ganxilva gasaSleli xidebisa – rogorc transformirebadi sistemebisa, iZleva maTi satransporto dakecili paketidan gacilebiT meti gabaritebis xidebis Seqmnis SesaZleblobebs.

swored gasaSleli xidis analizi, transformaciis mixedviT, formaTwarmoqnis TeoriiT da saTanado daskvnebis gakeTebiT, warmoadgens kvlevis erT-erT ZiriTad mizans, romelic am TavSia mocemuli [8].

Tu meqanizebul xids warmovidgenT transformirebad sistemad, maSin igi Sedgeba ori ZiriTadi blokisagan:

— xidgamdebis bloki, romelic warmoadgens saTanado meqanizmebiT aRWurvil satransporto-samontaJo saSualebas;

— xidis blokebisagan, romelic erTi an ramodenime elemenrebisagan Sedgeba.

maTi mTlianobaSi, transformirebad sistemebad ganxilvisas SeiZleba orive bloki iyos formaTwarmoqmnis monawile, an SesaZlebelia mxolod xidis bloke asrulebdes transformaiis procesebs.

meqanizirebuli xidebi, ganapirobeben saxide konstruqciisa da sabazo manqanis gansazRvrul damoukideblobas. es yovelive, uzrunvelyofs misi damzadebis teqnologiisa da mTliani konstruqciis SedarebiT simartives da qmnis sabazo manqanebis saxiT, meqanizirebuli xidebis manqanaTa, seriulad warmoebis SesaZleblobas, rac gansazRvravs aseTi gaerTmTlianebis ekonomikur mizanSewonilobas.

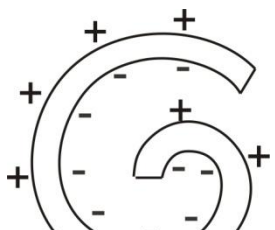
sabazo manqanis specialur xidgamdeb manqanad gadaqceva, iZleva misi gauniversalurebis saSualebas. erTidaigive xidgamdebi, mimdevrobiT SeiZleba gamoyenebul iqnas, ramodenime zRudeze xidis gadebisaTvis, rogorc sakuTari xidgamdebiT gadasatani, aseve saTadarigo, Cveulebrivi transportiT gadamtani saxide konstruqciebisaTvis. es faqti zrdis SesaZlo ekonomikur efeqts, vinaidan meqanizirebuli xidebis sakmaod ZviradRirebul nawils warmoadgens xidgamdebi.

meqanizirebul xidebSi, xidgamdebis meSveobiT, arsebobs xidis gadebis ramodenime meTodi: wamocmiT an gadabrunebiT, rogorc mTeli, aseve dakecvadi maliani nagebobebis da an saxide blokebisa.

miuxedavad amisa, gasaSleli xidebis, rogor transformirebadi sistemebis, formaTwarmoqmnis Teoria, maT erTianobaSi ganixilavs. amis safuZvels warmoadgens transformirebadi sistemebis Teoria [9].

gasaSleli xidebis konstruirebis logikis mixedviT, mniSvnelovania transformirebadi sistemebis Teoria, romelSic ganxilulia formaTwarmoqmnis sami ZiriTadi principi:

1. ***daxvevis principi***. (fig. I. 1)



aseT modelSi sistemis daxvevis an gaSlis dros, Sesabamisad adgili aqvs misi sapirispiro mxareebis (+ _) urTierT-daaxloebas an daSorebas, rac simboloebis mixedviT Semdegnairad daiwereba:

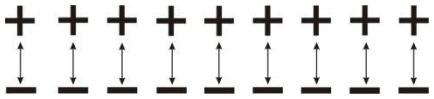


fig. I.1

2. ***dakecvis principi.*** (fig. I. 2)

aseT modelSi sistemis dakecvis an gaxsnis dros Sesabamisad adgili aqvs misi erTidaigive mxareebis (+ ; +) da (_ ; _) erTmaneTan daaxloebas an daSorebas, rac simbolebis mixedviT SemdegnairaT daiwereba:

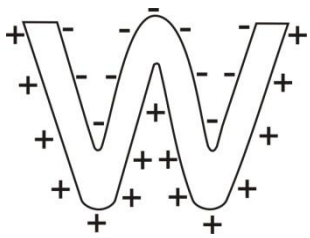
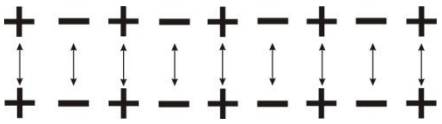


fig. I.2

3. ***teleskopi*** fig. I.3)



aseT modelSi sistemis dakecvisa da gaxsnis dros, adgili aqvs sxvadasxva elemen-tebis, sxvadasxva simboloebis (+ _) mqone zedapirebis urTierT grZivad gadaadgile-bas. es iwvevs dakecvasa da gaxsnas, rac simboloebiT Semdegnairad daiwereba:

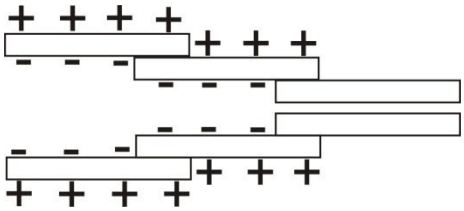


fig. I.3

ganxiluli principebis mixedviT, Tu gavakeTebT sistematizacias, maSin gasaSleli erTmaliani xidebis gaSla-dakecva da gadasalax winaaRmdegobebze gadebis Semdeg logikur sqemebs miviRebT, romlebic mTlianobaSi or ZiriTad jgufad iyofa.

transformaciis procesebis or ZiriTad jgufad dayofa, gamowveulia imiT, rom sistemebis analizisaTvis moxdes gancalkeveba procesebisa, rac dakavSirebulia xidis, rogorc erTiani transformirebadi sistemis damoukideblad ganxilvisa, imisda mixedviT igi winaaRmdegobaze gaideba “wamocmis” Tu “gadabrunebis” meTodiT.

I. 2. transformirebadi sistemebis principuli sqemebis ganxilva “wamocmis” meTodiT asageb xidebSi.

zRudeze xidis gadeba, rogorc erTiani konstruqciuli sistemisa, rig SemTxvevaSi, xorcieldeba “wamocmis” meTodis gamoyenebiT.

aseT SemTxvevaSi xidis erTiani malis naSeni xidgamdebis saSualebiT gadaadgildeba gadasalaxi dabrkolebis mimarTulebiT. mTliani, gaxsnili konstruqcia eyrdnoba dabrkolebis mopirdapire napirs da mxolod amis Semdeg xdeba misi mocileba xidgamdebidan, dabrkolebis uaxloes napirze daSvebiT. manmade xidi, rogorc erTiani konstruqciuli sistema omyofeba konsolur mdgomareobaSi, romelic Camagrebulia xidgamdebis specialur mowyobilobaSi.

xidis konstruqcia dakecva–gaSlis gareSe miitaneba da gaideba gadasalax winaaRmdegobaze “wamocmis” meTodiT (fig. I.4)

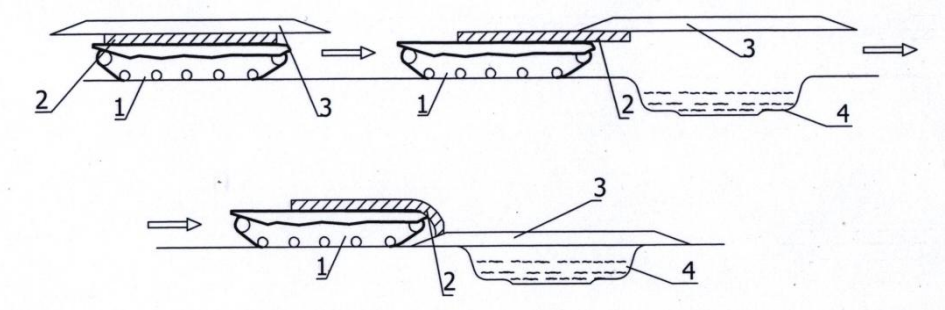


fig. I.4

1. - satransporto saSualeba; 2. - samontaJo saSualeba; 3. - xidis konstruqcia; 4. - gadasalaxi winaaRmdegoba.

aRniSnuli sqema saieriSo xidebisa farTod iyo gamoyenebuli adrindel gadawyvetebSi. amis magaliTad SeiZleba ganvixiloT modifikaciebi rusuli xidgamdebisa - МТУ (fig.I.5).

aseTi xidebis sigrZe, gamomdinare misi satransporto paketis zRvruli gabaritebidan, ar SeiZleba yofiliyo 12 metrze meti [10].

a) b)

g)

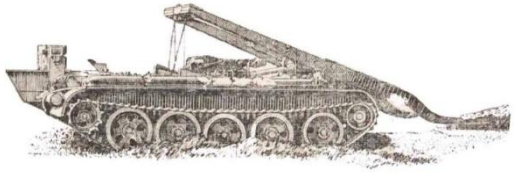


fig. I.5 xidis gadebis procedura gadasalax dabrkolebaze Sesrulebuli xidgamdebis mier "wamocmis" meTodiT.
a) xidi konsolurad aris gamoweuli xidgamdebidan;
b) xidi daeyrdno gadasalaxi winaaRmdegonis Soreul napirs;
g) xidgamdebba dauSca xidi axlo napirze.

xidis konstruqciis gadebis procesi gadasalax winaaRmdegobaze, rodesac is xorcieldeba xidgamdebze "wamocmis" meTodiT, aumjobesebs xidgamdebis momsaxure personalis xedvis areals. samuSao zonis xedva sakmao diapazonSia rogorc xidis gadebis. aseve misi dabrkolebidan axsnis procesSi. da es procedura, rogorc wesi, xorcieldeba xidgamdebis ekipaJis _ momsaxure personalis javSanmanqanidan gadmosvlis gareSe.

gansakuTrebuli upiratesoba xidis gadebisa "wamocmis" meTodiT aris misi gaSla da aRebis procesSi, xidis mudmivi mdebareoba dabal doneze da amasTan erTad horizontalur mdgomareobaSi, rac maqsimalurad uzrunvelyofs masze saceccxle zemoqmedebis warmoebas.

mTlianobaSi, xidis dakecili konstruqciis satransporto paketi, romelic ganTavsebulia xidgamdebze unda akmayofilebdes daSvebul satransporto gabaritebs. es SezRudva Seexeba mis sigrZes, romelic Seadgens 12_13 an ukeTes SemTxvevaSi 15_16 metrs, da mis simaRles, rac myarad aris gansazRvruli sxvadasxva qveynebis mixedviT da misi minimaluri mniSvneloba aRwevs 4m-s.

rac Seexeba xidis siganes, igi taqtikuri da operatiuli moTxovnebidan gamomdinare aiReba maqsimum 4,2 metris toli.

amdenad, garkveuli winapirobis Semdeg, dabrkolebaze xidis gadebis "wamocmis" meTodiT SesaZlebelia transformaciis Semdegi martivi procesebis ganxilva.

I. xidis malis danawevrebuli blokebiT da teleskopuri isriT, xidis malis naSenis mowyoba gadasalax winaaRmdegobaze (fig. I.6).

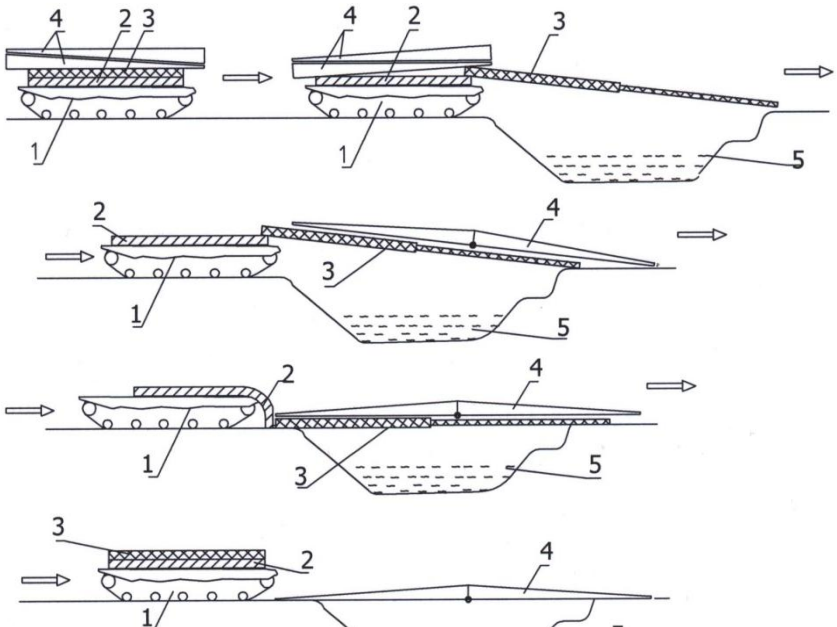


fig. I.6
1. satransporto saSualeba; 2. samontaJo saSualeba; 3. teleskopuri isari; 4. xidis malis danawevrebuli blokebi; 5. gadasalaxi winaaRmdegoba.

aRniSnuli meTodi garkveulwilad gulisxmobs transfor-mirebadi sistemebis, Cvens mier zemoT ganxiluli, "teleskopis princips". amasTan, masSi gansakuTrebiT xidis ori blokis gaerTianeba malis naSenad SeiZleba SevadaroT asawyobi elementebisagan konstruqciis montaJs. yvela SemTxvevaSi warmodgenili sqema pirvel etapze warmoadgens asawyobi xidis malis naSenisaTvis teleskopuri bazis Seqmnas da Semdgom massze, malis blokebis mimdevrobiTi "dacurebiT" da gaerTianebiT, gadasalax winaaRmdegobaze xidis ageba [11].

analogiuri sqemiT xorcieldeba, erT satransporto saSualebaze ganTavsebuli germanuli xidis MLC70 LEGUAN montaJi. igi tank "leopardis" bazazea Seqmnili. misi saSualebiT 26 metriani winaaRmdegobis daZleva SeiZleba (fig. I.7).

a)

b)

fig. I.7 – a) xidgamdebi, romelic xids gadasalax winaaRmdegobaze debs "wamocmis" meTodiT satransporto mdgomareobaSi; b) xidgamdebi, teleskopis isris gamoyenebiT amontaJebs "teleskopis principiT' transformirebad xids.

aseTi principi, SedarebiT Sromatevadi da rTulia "saieriSo" xidebisaTvis. amasTan, igi Zalian efeqturad gamoiyeneba egreTwodebuli "gamyoli" xidebis Seqmnisas.

gamyoli xidebis agebisas, romelTa sigrZe 48-60 metrsac ki aRwevs, gamoiyeneba specialuri samontaJo teqnika da mraval satransporto saSualebebze ganTavsebuli xidis malis calkeuli blokebi. amasTan, montaJis dro 30- 45 - 120 wuTamdec ki izrdeba (fig. I.8).

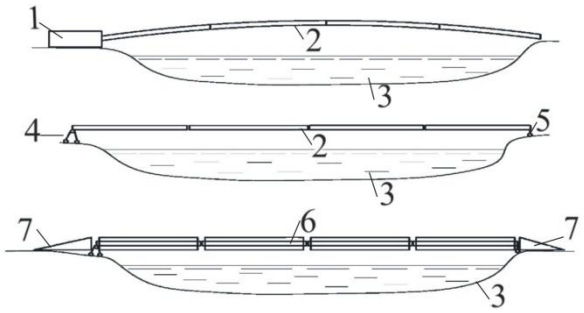


fig. I.8 _ samontaJo elementebi da maTze agebuli xidis mali

1. -xidis montaJis meqanizmi; 2. isari, romelic igeba teleskopurad an TanmimdevrobiTi montaJiT; 3. gadasalaxi winaaRmdegoba; 4_5. xidis sayrdenebi napirze; 6. malis calkeuli blokebi; 7. xidze Sesasvlelebi.

yvelaferi es, montaJis dros satransporto saSualebebis raodenobisa da momsaxure personalis manqanidan gadmosvlis gamo, miuRebelia "saeriSo" xidebisaTvis.

unda aRiniSnos, rom xidis ageba samontaJo isris gamoyenebiT farTo gavrcelebas poulobs egreT wodebul "gamyol" xidebSi.

Seqmnilia mravali erTmaliani gamyoli xidebi. maT Soris aris Sveduri FAST BRIDGE 48 (FB 48) da germanuli DoFB (fig. I.9; fig. I.10).

a) b)

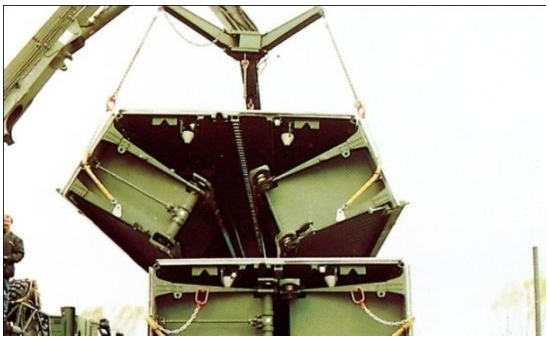
g) d)

fig. I.9 – Sveduri, 48 metri malis, "gamyoli" asawyob-dasaSleli xidi.

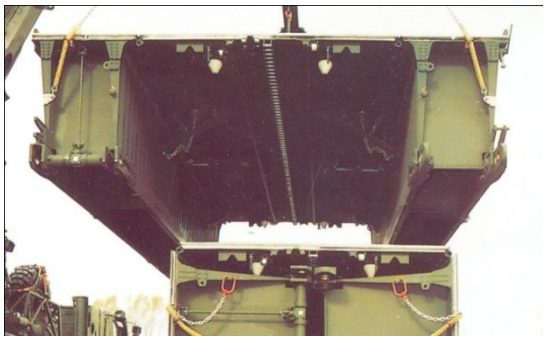
a) xidis "isris" ageba; b) sanapiro blokis mowyoba; g) xidis mzidi konstruqciis asawyobi blokebis montaJi; d) xidi saeqsploatacio mdgomareobaSi.

a) b)

g)



d)



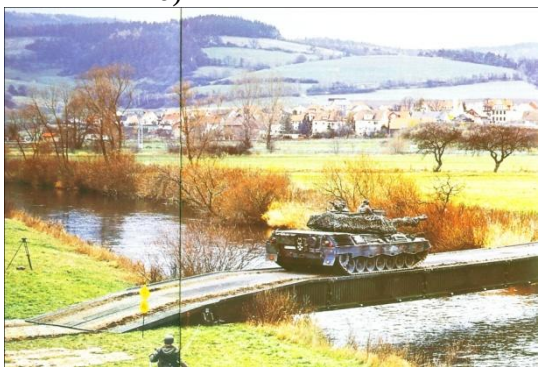


fig. I.10 – germanuli, 48 metri malis, “gamyoli” asawyobi _ transformirebadi xidi.

a) xidis sayrdeni “isris” montaJi; b) xidis mzidi transformirebadi blokis firmaTwarmoqmnis procesis ganxorcieleba; g) gaxsnili transformirebadi xidis blokis montaJi; d) xidi saeqsploatacio mdgomareobaSi.

SemoTavazebuli didi zomis erTmaliani xidebi zomiT 48÷60 metri, romlebic mzidi karkasis isris gamoyenebiT xorcieldeba, ar SeiZleba gamoyenebuli iqnas egreT wodebul “saieriSo” xidebSi. damatebiT ori pirobis gamoc.

jer erTi, isini saWiroeben did dros mzidi karkasisa da Semdgom masze malis nawilebis mosawyobad da, meorec is, rom maTi ganTavseba xdeba mraval satransporto saSualebaze.

II. xidis malebis danawevrebuli blokebisagan mTliani malis naSenis mowyoba da misi gadeba gadasalax winaaRmdegobaze (fig.I.11).

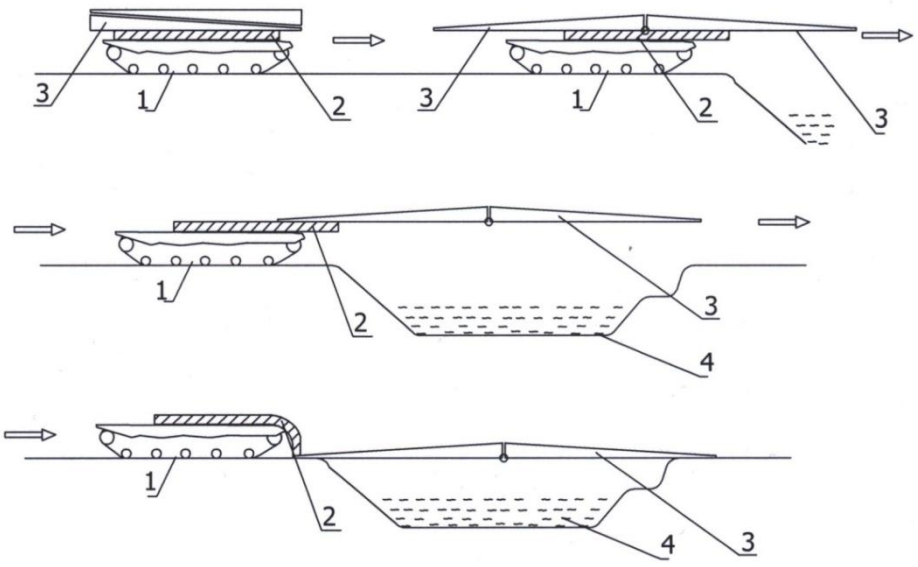


fig. I.11

1. satransporto saSualeba; 2. samontaJo saSualeba; 3. xidis malis konstruqcis danawevrebuli blokebi; 4. gadasalaxi winaaRmdegoba.

gansxvavebiT wina SemTxvevisgan, xidis montaJi aRniSnuli sqemiT warmoadgens tipiur SemTxvevas transformaciiT formis Seqmnis mesame principisa. aq xdeba urTierTgasrialeba xidis konstruqciis blokebisa da, bolo etapze, maTi gaerTianeba [12].

figuraze (fig. 12) warmodgenilia konkretuli magaliTebi mocemuli meTodiT xidebis agebisa, saTanado kompaniebis da xidgamdebebis taqtikuri da teqnikuri parametrebis CvenebiT.

a) b)

fig. I.12 - LEGUAN sistemis xidgamdebi, gasaSleli xidiT.

a) xidgamdebi da masze ganTavsebuli 26 metri sigrZis xidis ori nawilisagan Semdgari paketi; b) gamTlianebuli xidi, romelic konsolur mdgomareobaSi emagreba xidgamdebs.

LEGUAN-1 sistemis xidgamdebis da xidis ZiriTadi parametrebia:

saerTo wona _ 50,00 t; xidis savali nawilis sigane _ 3,850; xidgamdebis maqsimaluri simaRle dakecil paketTan erTad _ 4,01 m; xidis dakecili paketis sigrZe _ 13, 37 m; xidis sruli sigrZe _ 26 m; samxedro tvirTis klasi _ MLC_70; konstruqciuli masala – aluminis Senadnobebi; xidis wona _ 10,8 t.

LEGUAN-is sistema aseve ganxorcielebulia pnevmo-sagoravebian transportze ganTavsebiT (fig. I.13) da (fig. I.14).

fig. I.13 - LEGUAN-is sistemis gasaSleli xidi ganTavsebuli avtomisabmelian saavtomobilo satransporto saSualebaze.

fig. I.14 – LEGUAN-1-is sistemis xidis gaSlis procesi.

aRsaniSnavia, rom saavtomobilo xidgamdebebi farTod gamoiyeneba rogorc samxedro miznebisaTvis “gamyol” xidebadac da aseve samoqalaqo miznebisaTvisac eqstremalur situaciebSi da sagangebo viTarebebSi.

xidgamdebis mier xidis agebis “wamocmis” meTodi sakmaod arTulebs xidgamdebze mowyobil meqanikur sistemebs. isini faqtiurad warmoadgenen mravalfunqciur agregatebs, romlebic xid emagrebian satransporto mdgomareobaSi, smTlisnebs mas montaJis win, risTvisac xidis calkeuli blokis gamaerTianebeli kvanZebis montaJic xidgamdebis mowyobilobam unda uzrunvelyos, da rac mTavaria, konsolurad “ukaviaT’ mTliani, gaSlili xidis konstruqcia, romlis Semdeg aseve xidgamdebis meqanikam unda uzrunvelyos misi daSveba gadasalaxi dabrkolebis napirebze.

miuxedavaT aseTi sirTuleebisa, xidmSeneblobaSi gamoiyeneba ara ori blokisagan Sedgenili xidebi, romlebic urTierTis mimarT “gasrialebis principiT” aigebian, aramed sami blokisaganac xdeba xidebis Seqmna (fig. I.15) [13].

a) b)

fig. I.15 – xidgamdebi xidis PSB2 sami blokiT datvirTuli

a) xidgamdebi satransporto mdgomareobaSi;
b) xidi saeqsploatacio mdgomareobaSi.

xidgamdebi, swrafadasagebi modelebiani xidisa PSB2 warmoadgens xidmSeneblobis axali Taobis SesaZleblobebs: moduluri, maqsimaluri mobilurobiT brZolis velze da minimaluri danaxarjebiT gadasasvlelze. es inovaciuri produqti gamoirCeva teqnikuri Sesrulebis srulyofiT. PSB2 imarTeba orkaciani razmiT da miekuTvneba MLC-70 klass muxluxa saSualebebisa da MLC100 Tvliani satransporto saSualebebisaTvis. LEOPARD 2 chassis Sasi uzrunvelyofs mobiluribas da saimedoobas, agreTve saerTaSoriso standartizacias da sistemis Tavsebadobas.

sami saxide moduli, TiToeulis sigrZe 9,7 m, SesaZlebels xdis dabrkolebis siganis Sesabamisad moaxdinos kombinacia da Sesabamisad vRebulobT – 9,7, 18,7 da 27,7 metiris xids.

PPSB2 ZiriTadi maxasiaTeblebia:

• samxedro tvirTis klasi MLC 70/100 xidisaTvis;
• xidebis moduliri sistema, romelic Sedgeba sami modelisagan, TiToeuli 9,7 m.
• erTi modulis wona 5,040 kg.
• modulebis sami kombinacia: 9,7, 18,7 da 27,7 m. xidis TiTo kombinaciis Sesabamisi wona: 5,040 kg, 10080 kg, 15120 kg.
• horizontaluri gaSla.
• gaSlis dro _ 5 w. (moklemaliani xidisaTvis), 10 w. (grZelmalian xidisaTvis).
• cveTa – 30 weli (1000 gadalaxva 3000 gaSla).

gaSlis (gasaSleli) mowyobiloba, xidis saWirosigrZis Sesabamisad, uzrunvelyofs “saxide modulebis gamowevas “saxide sawyobidan”.

miuxedavad CamoTvlili mravali dadebiTi Tvisebebisa, “saieriSo” xidebSi, romlebic teleskopis principiT gulisxmobs formaTwarmoqmnas, warmoiSoba malis SezRudva _ 24, maqsimum 32 metris farglebSi. amis Semdeg SeuZlebeli xdeba misi

zrda, rac pirvel rigSi xidis blokebiT datvirTuli xidgamdebis gabaritebis, upiratesad ki simaRlis pirobiT aris SezRuduli. amitom, rig SemTxvevaSi, malis gazrdisaTvis SemoTavazebulia or xidgamdebze ganTavsebuli xidebi [14] [15].

I. 3. transformirebadi sistemebis principuli sqemebis ganxilva “gadmobrunebis” meTodiT asageb xidebSi

samxedro gasaSlel meqanizebul xidebSi farTod gamoiyeneba xidgamdebis mier xidis gadasalax dabrkolebaze “gadabrunebiT” agebis meTodi [16] [17].

rodesac xidgamdebis mier xidis agebis meTods ganvixilavT, kvlav avRniSnavT, rom aRniSnuli meTodi ar gulisxmobs TviT xidis transformaciis procesebs. aq xidis konstruqciis formaTwarmoqmna ki ar ganixileba, aramed sakiTxi Seexeba xids, rogorc erTiani konstruqciis gadasalax winaaRmdegobaze xidgamdebis mier agebis meTods. sqematurad es meTodi warmodgenilia fig. I.16-ze.

xidis konstruqciis “gadabrunebis” meTodiT gadeba gadasalax winaaRmdegobaze (fig. 16).

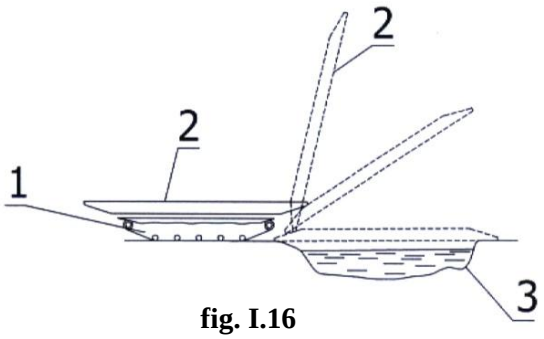


fig. I.16

1 _ satransporto saSualeba; 2 – xidis malis konstruqcia;
3 _ gadasalaxi winaaRmdegoba.

aRniSnuli meTodis mixedviT Seqmnilia mravali xidgamdebi. maT Soris didi britaneTis SeiaraRebaSi arsebuli “Titan” _ Armoured Vehicle Launcher Bridge (AVLB). xidgamdebebi agebulia ZiriTadad mZime tankebis Chie Ftain da Chellebger-2–is bazaze (fig.I.17).

xidis ageba “gadabrunebis” meTodiT aiolebs dasayenebeli meqanizmebis marTvas, vinaidan mZRol-meqanikosisTvis umjobesdeba xidis agebisaTvis saWiro arialis xedva, magram mowyobilobebis sistema da sxva meqanizmebi, romelTa meSveobiTac xorcieldeba xidis gadabruneba, garkveulwilad uzRudavs mZRol-meqanikoss xedvis arialis garCevadobas.

fig. I. 17 – “Titan”-is klasis erTmaliani da erTblokiani xidis montaJi, xidgamdebidan misi ”gadabrunebiT”.

meqanizirebul xidebSi, saxide konstruqcia, specialuri meqanizmebi da sabazo manqana, rogorc savele svlisas, aseve xidis gadebisas, konstruqciulad mudmivad dakavSirebulni arian erTmaneTTan. Tavad sabazo manqana warmoadgens xidis sabjens. amgvari meTodis gamoyenebiT, ukeTaa SesaZlebeli, rom xidis dabrkolebaze gadebis yvela amocana gadawyvetil iqnas, ekipaJis manqanidan gadmousvlelad. amasTan, SesaZlebelia miRweul iqnas, xidis zRudeze gamoyenebis mzadyofnis maRali xarisxi da agebis swrafi tempi.

“gadabrunebis” meTodiT SemoTavazebuli xidebis did nawilSi gamSleli energetikuli meqanizmebi TbiT gasaSlel xidSia ganTavsebuli [18].

aseve gasaTvaliswinebelia is garemoeba, rom “gadabrunebis” meTodiT xidis agebis, misi radioaqtiur adgilas eqspluataciis, an misi talaxiT Zlieri dabinZurebis Semdeg xidis xidgamdebze ganTavsebamde aucilebelia savali nawilis gulmodgine gasufTaveba da mxolod ukve amis Semdeg, misi akecva da xidgamdebze datvirTva. es aixsneba imiT, rom mTeli maliani nageboba xidgamdebze, ideba savali nawiliT qvemoT da Sesabamisad mTeli mowamluli grunti xvdeba sabazo manqanis transmisiasa da xidis dasayenebel meqanizmebSi. es procedurebi ar aris iolad Sesasrulebeli da isini garkveul dros moiTxoven.

aseve gasaTvaliswinebelia xidis “gadabrunebis” meTodiT gamoyenebisas, xidis vertikalur poziciaSi yofnisas misi ganivi mdgradobis Semcireba.

rogorc aRiniSna “saieriSo” xidebi SeiZleba xidgamdebze ganTavsdes, rogorc erTiani konstruqcia misi danawevrebis da danawevrebul nawilebs Soris kavSirebis mowyobis gareSe, aseve transformirebadi sistemis saxiT [19].

swored “gadabrunebis” meTodiT xidis agebisas, transformirebadi xidebis SemTxvevaSi farTod gamoiyeneba xidis formaTwarmoqmna “makratelis” da “ormagi makratelis” sqemebis mixedviT.

es principi iZleva saSualebas xidis satransporto gabaritis – sigrZis Semcirebisa imis sanacvlod, rom igi Sedgeba saxsrulad dakavSirebuli ori an sami blokisagan.

pirvel rigSi ganvixiloT xidis formaTwarmoqmna “makratelisebri” konstruqciisagan.

I. xidis malis “makratlisebri” konstruqcia (fig. I.18).

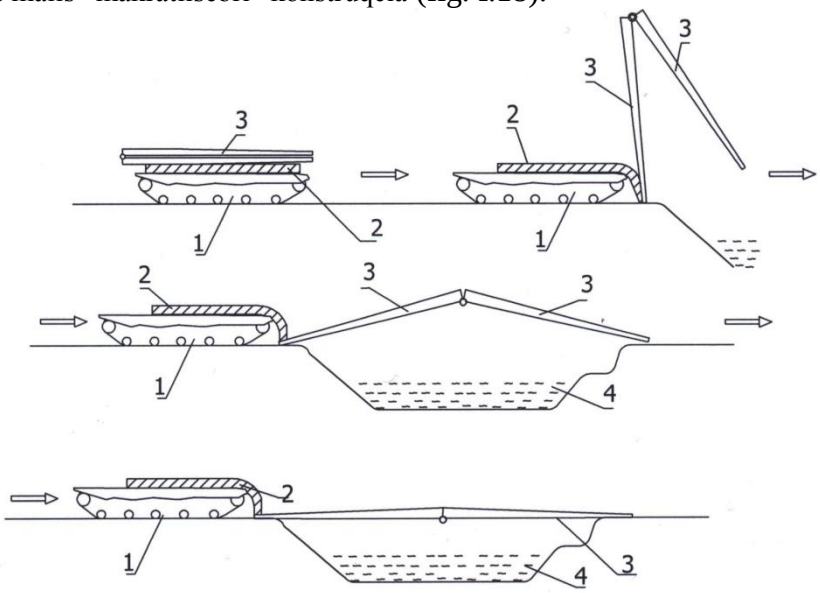


fig. I.18

1 _ satransporto saSualeba; 2 _ samontaJo saSualeba; 3 _ ori nawilisagan Semdgari, makratelas principiT gaerTianebuli malis konstruqcia; 4 _ gadasalaxi winaaRmdegoba.

xidis malis sidide, satransporto paketSi misi danawevrebuli dakecvis gareSe, rogorc wesi, ar SeiZleba iyos 12 metrze meti, Tumca arsebobs 16 metri sigrZis satranspirto paketebic, rac zogadad transportirebis pirobiT aris SezRuduli. amitom gasaSleli xidebi da, miT umetes, samxedro xidebi, ZiriTadad “makratelis” principis mixedviT xorcieldeba.

am mxriv, realurad ganxorcielebulia mravali xidis konstruqcia da maTi modifikaciebi (fig. I.19).

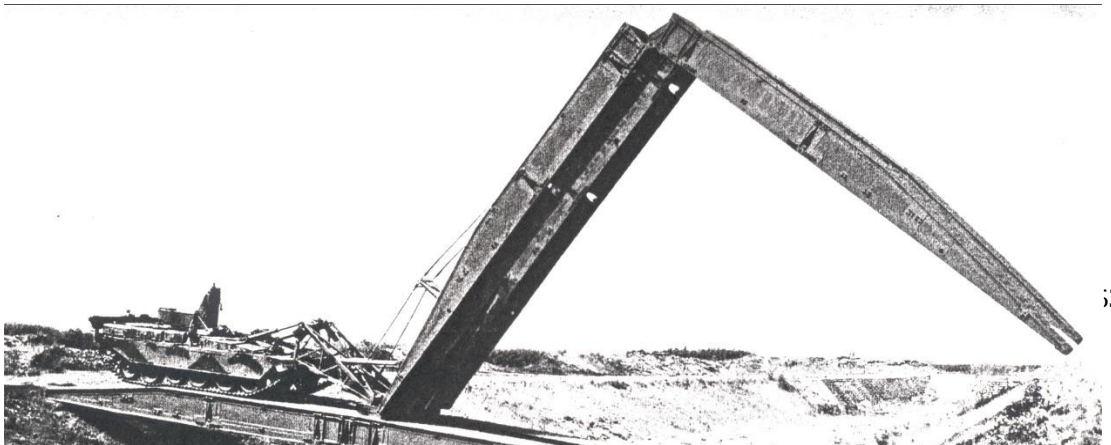


fig. I.19 – gasaSleli xidis “makratlisebri” konstruqcia.

ganxiluli xidgamdebi da “makratlisebri” xidis konstruqcia saSualebas iZleva gadailaxos dabrkoleba maliT 24,5 metri. mTlianad ganxiluli xidis zoma sigrZeSi Seadgens 26 metrs.

garda fig. I.15-ze warmodgenil saieriSo xidis da xidgamdebis sqemisa, romelic yvelaze metad iyo da aris gavrcelebuli, saieriSo xidebSi aseve SesaZlebelia sami nawilisagan Sedgenili, saxsrulad dakavSirebuli, xidis malis konstruqciis gamoyenebac.

II. xidis malis orsaxsriani dasakec-gasaSleli konstruqcia “ormagi makrateli” (fig. I.20).

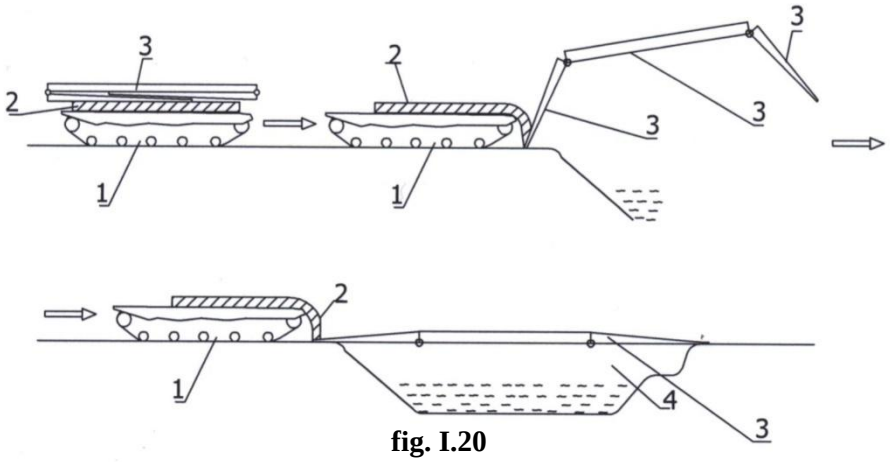


fig. I.20

1 _ satransporto saSualeba; 2 _ samontaJo saSuleba; 3 _ sami blokisagan Semdgari, erTmaneTTan saxsrulad dakavSirebuli xidis malis konstruqcia; 4 _ gadasalaxi winaaRmdegoba.

xidis dakecili paketis aseTi konfiguracia gaaCnia rusul gasaSlel erTmalian xids – МТУ-90, romelic xidgamdebzea ganTavsebuli (fig. I. 21).

a)B b)

fig. I. 21 – xidgamdebi “ormagi makrateliani” xidiT.

a) xidgamdebi sam nawilad dakecili xidiT; b) “ormagi makrateliani” xidis transformaciis procesi.

aRsaniSnavia, rom МТУ-90-Si xidis gadeba da aReba SesaZlebelia gadasalaxi winaaRmdegobis orive mxridan.

amdenad, erTmaliani gasaSleli xidis Seqmna SesaZlebelia transformirebadi sistemebis formaTwarmoqmnis daxvevis principiT da dakecvis principiT.

satanko xidgamdebi МТУ-90 gaTvaliswinebulia erTmaliani, liTonis 24 metriani xidis gasadebad, romlis tvirTamweoba 50 tonas Seadgens. xidis konstruqcia Sedgeba erTmaneTTan saxsrulad dakavSirebul sami nawilisagan. maTgan erTi – Sua nawili orqanobiania da mas orive mxridan emagreba calqanobiani, samkuTxa formis nawilebi.

“gadabrunebis” meTodiT xidebis agebis magaliTia xidsabjeniani manqanebi, romlebmac sxvadasxva konfiguraciebiT hpoves gavrceleba.

xidebSi sabazo manqanebi gamoiyeneba Sualeduri sabjenebis saxiT. xidis asagebad, manqanas uwevs zRudeSi Sesvla da Tavis sam iarusad dakecil maliani nagebobis gaSla.

meqanizirebuli xidebis ZiriTad naklad SeiZleba CaiTvalos, maTi gazrdili damokidebuleba zRudeebis xasiaTis mimarT. manqanis zRudeSi Sesasvlelad, saWiroa sakmaod myari grunti, xolo wylis siRrme ar unda aRematebodes 1.5÷1.8 m-s. es ukanaskneli, xsnis sabazo manqanebis hermetizaciis sakiTxs, gansakuTrebiT im zeda nawilisas, sadac ganlagebulia maliani nagebobis gaxsnis meqanizmebi.

III. xidis malebi ormxrivi gadaSliT (fig. I. 22).

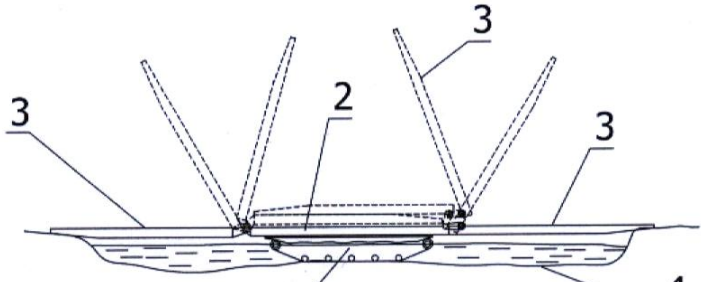


fig. I. 22

1 _ satransporto saSualeba; 2 – xidis uZravi mali;
3 – gadasaSleli malebi; 4 _ dabrkoleba.

magaliTad SeiZleba moviyvanoT inglisuri varianti xidgamdebisa, romelsac orive mxares aqvs saxsrulad mierTebuli malebi (fig. I. 23).

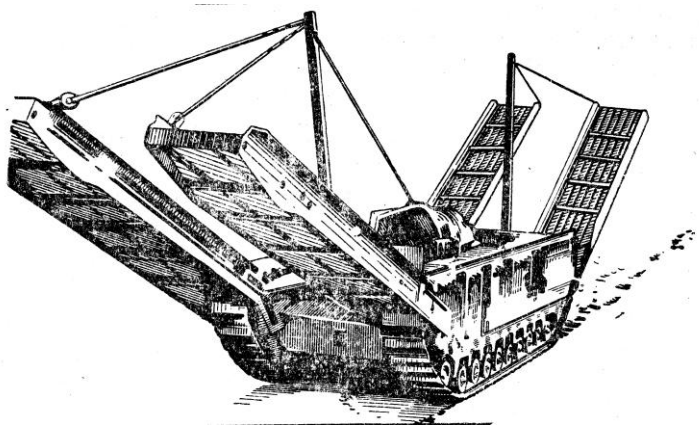


fig. I. 23 – inglisuri xidgamdebi, romelsac aqvs ormxrivad gadasaxsneli malebi.

analogiuri varianti damuSavda saqarTvelos teqnikuri universitetis negebobebis, specialuri sistemebisa da sainJinro uzrunvelyofis institutSi (fig. I. 24).

fig. I. 24 – malebis ormxrivi gadaSlis samxedro xidis proeqti.

IV. xidis malis “makratlisebri” konstruqcia satransporto saSualebaze mimagrebiT (fig. I. 25).

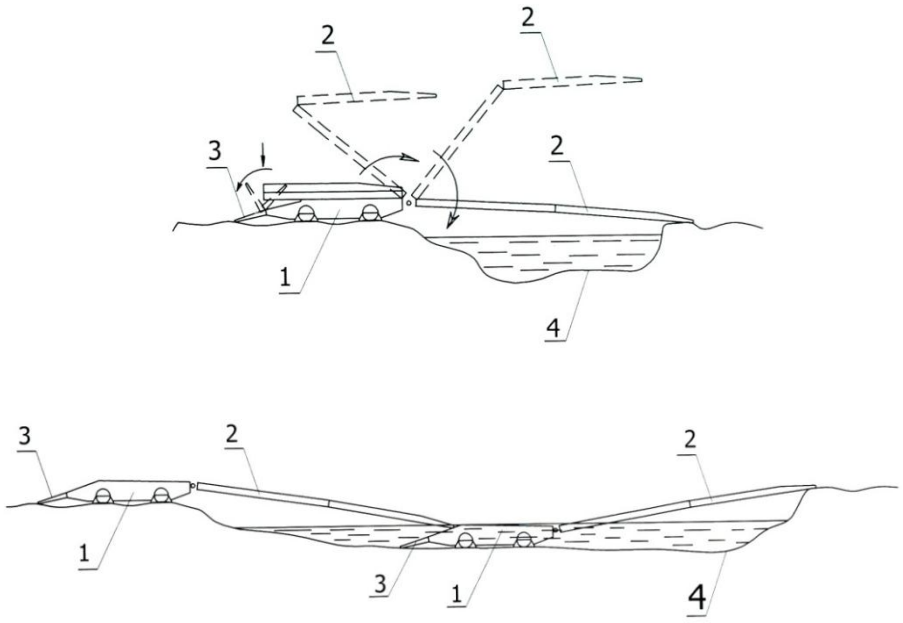


fig. I. 25

1 _ satransporto-samontaJo saSualeba; 2 _ “makratlisebri” mali;
3 _ xidze Sesasvleli; 4 _ dabrkoleba.

aRniSnuli tipis xidebis konkretuli ganxorcielebis variantia franguli “Jilua”-s tipis xidgamdebi.

borblebian sabazo manqanas, gaaCnia specialuri hermetiuli korpusi sigrZiT 11.65 m da siganiT 3.05 m. manqanis baqanis zeda nawili, warmoadgens xidis saval nawils. savele mdgomareobaSi, sabazo manqanis korpusis zemodan, mTlian sigrZeze, Tavsdeba korpusTan saxsrulad SeerTebuli da ~makratelas~ sqemis mixedviT dakecili maliani nageboba. korpusis ukana nawilSi, mdebareobs gadamayiravebeli apareli.

manqanis saerTo simaRle, Seadgens – 3.9 m-s. xidis agebisa da eqspluataciisas, savali nawilis Tvlebi Sedian korpusis SigniT. ~Jiluas~ manqanebi iZlevian saSualebas erTmaliani da ormaliani xidebis agebisa.

erTmaliani xidis, sigrZiT 22 m, warmosaqmnelad, manqana dgeba napiris kidesTan axlos, an napiridan cotaodeni gadakidebiTac. manqana eSveba korpusis ZiriT gruntze da meqanizirebuli xidis gaSlisas, misi gadabrunebis Tavidan asacileblad, sxva manqanis wonis dawolis Sedegad, simyarisaTvis, anxorcielebs jdomas gruntSi. maliani nageboba iSleba ~makratelas~ sqemis mixedviT da eyrdnoba kidiT sapirispiro napirs.

aRniSnuli tipis xidebis yvelaze mniSvnelovan nakls warmoadgens sapirispiro napirze xidis aSlis SeuZlebloba. ~Jiluas~ xidis ukanasknel nimuSebSi, aucileblobis SemTxvevaSi, SesaZlebelia maliani nagebobis korpusidan gamocalkeveba.

garda "wamocmis" an "gadabrunebis" meTodebiT xidebis agebisa, praqtikaSi aseve gvxvdeba xidis gadeba gadasalax dabrkolebaze gansxvavebuli meTodebiT. maT Soris yvelaze gavrcelebulia gidis gadeba gadasalax winaaRmdegobaze amwis isridan an kidev, Tundac vertmfrenis ganTavsebuli jalabris saSualebiT.

aseT SemTxvevaSi erTiani xidi, romelic SeiZleba iyos aseve transformirebadi, srulyofili, gaSlili saxiT, dabrkolebis napirebs paralelurad uaxlovdeba, xolo Semdgom gaideba gadasalax winaaRmdegobaze.

am meTods pirobiTad vuwodeT xidis "paraleluri" gadaadgilebiT agebis meTodi.

I. xidis malis daxveul-gasaSleli konstruqcia (fig. I. 26).

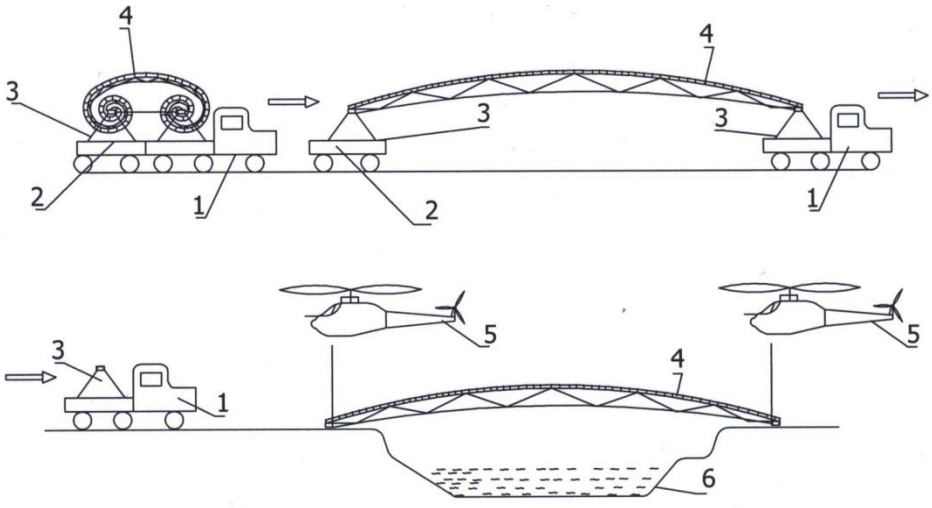


fig. I. 26

1 _ satransporto saSualeba; 2 _ mimyoli satransporto saSualeba;
3 _ samontaJo elementebi; 4 _ dasaxvevi xidis konstruqcia;
5 _ vertmfreni; 6 _ gadasalaxi winaaRmdegoba.

mocemul SemTxvevaSi dasaxvevi "saieriSo" xidis konstruqcia metad danawevrebulia. amasTan, konstruqciuli Taviseburebebidan gamomdinare rTuldeba misi daWera sxva mdgomareobaSi, garda saeqsploatacio mdgomareobisa. swored amitom iqna montaJis sqemebSi gamoyenebuli ori vertmfreni, rac aseve arTulebs misi gadebis samuSaoebs gadasalax winaaRmdegobaze.

miuxedavaT aseTi sirTuleebisa, SeiZleba iTqvas, rom aRniSnuli "daxvevis sqemiT" miRweulia konstruqciuli gadawyevata xidisa, romlis mali aris 32_48 metri, xolo wona 17_20 tonas Seadgens.

aRniSnuli tipis _ “daxvevis sqemiT” realuri konstruqciebis Seqmna da isic saieriSo xidebisaTvis kvlav moiTxovs axali variantebis Seqmnas da Seswavlas, rac xorcieldeba saqarTvelos teqnikuri universitetis nagebobebis, specialuri sistemebisa da sainJinro uzrunvelyofis institutSi.

I. 4. transformaciis martivi sqemebidan xidis sistemebis rTul, ori tipis Sewyvilebul formaTwarmoqmnis sqemebze gadasvla.

Tu SevafasebT warmodgenili sistematizaciiT erTmaliani xidis gadasalax winaaRmdegobaze gaSla-dakecvis logikur sqemebs, sxvadasxva dros sxvadasxva variantebs eZleodaT upiratesoba.

miuxedavaT amisa, sqemebi praqtikulad ar Seesabameba mocemul etapze gasaSleli xidebis konstruirebis logikas. es aris mcdeloba arsebuli erTmaliani xidebis klasikuri sqemebis daWris, saxsrebis dayenebis da kompaqturad dakecvis, romlis Semdeg xdeba maTi gamoyenebis adgilas gaSla da winaaRmdegobaze gadeba.

sqemebis mixedviT maTi klasifikacia Semdegi saxisaa:

A. gasaSleli xidebi ageba “wamocmis” meTodiT:

I sqema _ teleskopis principi – gasaSlel isarze gasrialebiT;

II sqema – teleskopis principi – xidis konsolurad CamagrebiT.

B. gasaSleli xidis ageba “gadabrunebis” meTodiT:

I sqema – dakecvis principi;

II sqema – daxvevis principi;

III sqema – dakecvis principi;

IV sqema – dakecvis principi.

C. gasaSleli xidis ageba “gadaadgilebis” meTodiT:

I sqema – daxvevis principi.

rogorc ganxiluli klasifikaciidan Cans, arc erTi sqema xidis gaSla-dakecvisa ar Seicavs rTuli gaSlis principebs, romelSic gaerTianebuli iqneba ori an sami principi formaTwarmoqmnisa. swored warmodgenil kvlevaSi es midgoma daedeba safuZvlad axali, ufro didi malis mqone xidebis sqemebis Seqmnas.

amasTan, unda iqnes daculi xidis dakecili satransporto paketis zRvruli gabaritebi, gansakuTrebiT ki sigrZe, romelic 12 metrs uaxlovdeba. aseve, misi zRvruli wona, rac satransporto pirobebiT aris gansazRvruli.

amdenad, SeiZleba iTqvas, rom erTmaliani xidebi, romlebic gankuTvnilia saieriSo sistemad:

— ver akmayofileben moTxovnebs malis gazrdisa 32_48 metramde;
— aRniSnuli malebis SemTxvevaSi veRar xerxdeba maTi swrafad ageba;
— amasTan, rig SemTxvevaSi, moTxovnebs emateba samuSaoebis Catareba meore napirzec;
— da gazrdili malis SemTxvevaSi izrdeba samontaJo da satransporto saSualebaTa ricxvi, rac miuRebelia saieriSo sistemebisaTvis.

aqedan gamomdinare, ZiriTadi mizania:

— Seiqmnas erTmaliani, didi zomis – 48 metramde malis mqone, gasaSleli xidis konstruqcia, romlis satransporto paketis sigrZe iqneba 12 metrze naklebi da igi ganTavsdeba erT samontaJo-satransporto saSualebaze;
— xidis montaJi da demontaJi ganxorcieldeba drois umcires SualedSi – maqsimum 10 wuTis intervalSi;
— xidis montaJi da demontaJi ganxorcieldeba momsaxure personalis samontaJo-satransporto saSualebidan gadmosvlis gareSe;
— xidis transportireba da gadasalax winaaRmdegobaze gadeba, garda satanko xidgamdebisa, SesaZlebeli iqneba avtomanqanidan da vertmfrenidanac.

aRniSnuli moTxovnebis mixedviT damuSavda mravali sqema saieriSo, 48 metri malis mqone xidebisa. maT safuZvels warmoadgens transformirebadi konstruqciebi, romelSic gadmocemulia gasaSleli sistemebis formaTwarmoqmnis logika. mis safuZvelze Seiqmna gasaSleli xidebis axali, sruliad gansxvavebuli konstruqciuli sqemebi.

transformaciis mixedviT ganisazRvra rTuli saxis formaTwarmoqmnis sqemebi. TiToeuli maTgani Sedgeba ori martivi formaTwarmoqmnis sqemisagan:

I – dakecvis principi + teleskopis principi;

II _ dakecvis principi + daxvevis principi;

I principis – dakecvis principi + teleskopis principi – gansxvavebuli konstruqciuli sqemebis mixedviT ganisazRvra mesame SemTxvevac:

III _ dakecvis principi + teleskopis principi.

rodesac xdeba gaSlis principebis ganxilva, unda SevTanxmdeT, rom erTi da igive transformaciis principiT SeiZleba SeirCes sxvadasxva tipis konstruqciuli sqemebi.

— arsebul “saieriSo” meqanizebul xidebSi, romlebic gadasalax dabrkolebaze aigebian “wamocmis” an “gadabrunebis” meTodiT, ver akmayofileben moTxovnas 24÷32 metris zemoT malis zrdisa, rac pirvel rigSi SezRudulia xidis dakecili paketis satransporto gabaritebiT.
— arsebuli “saieriSo” meqanizebuli xidebis, gadasalax dabrkolebaze xidis dasrulebuli, gaSlili formis warmoqmnas, rogorc transformirebadi sistemebis formaTwarmoqmnis Teoriidan gairkva, axorcieleben transformaciis saxeobebida erTi romelime principiT.
— disertaciaSi dasaxuli miznis misaRwevad, rac warmoadgens meqanizebuli, erT satransporto saSualebaze ganTavsebuli, saieriSo gasaSleli xidebis malis, Semdgom 24_32 metrze meti sididiT Seqmnas, aucilebelia xidebis transformaciis ara erTmagi, aramed pirvel rigSi ormagi transformaciis principze gadasvla.

V. transformaciis ormagi principiT agebuli gasaSleli xidebis konstruqciuli srulyofa da transformaciis sammag principze gadasvlis aucilebloba

V. 1. “dakecvis princips”+”daxvevis proncipiT” Seqmnili xidis Secvla “dakecvis princips” + “dakecvis principiT” Seqmnili transformirebadi xidiT.

Catarebulma Teoriulma da eqsperimentulma kvlevebma da gansakuTrebiT “dakecvis princips” + “daxvevis principiT” Seqmnili xidis sqemis konstruirebis logikam, wina planze wamowia is mimarTulebebi cvlilebebisa, romlebic gaamartiveben konstruqcias da Seamcireben misi dakecili satransporto paketis simaRles, rac esoden mniSvnelovania [32] [33] [34].

am mxriv, “dakecvis princips” + “daxvevis principiT” Semnili transformirebadi xidis sqemaSi (ix. fig. III.1 da fig. III.2) moxda Zireuli cvlilebebi xidis gisosis da qveda sartyelebis sqemebSi. amasTan, SenarCunebuli iqna zeda kombinirebuli sartyeli, romelic gasaSleli xidis formaTwarmoqmnisas ZiriTad funqcias asrulebs xidis transformaciis procesSi, xolo xidis gaSlis bolo etapze gadaiqceva savali nawilis mzid konstruqciad (fig. V .1).

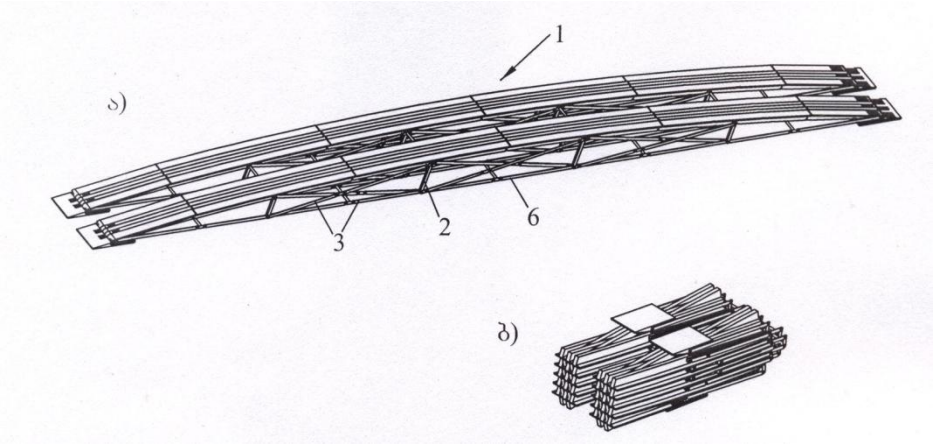


fig. V.1. - “dakecvis princips” + “dakecvis principiT” Seqmnili gasaSleli xidis konstruqciuli sqemebi.

a) gasaSleli xidis aqsionometriuli xedi;

b) xidis dakecili satransporto paketis xedi.

rogorc aRiniSna, gasaSleli xidis zeda sartyelebi 1, romlebic gaSlili xidis mdgomareobaSi saval nawils warmoadgenen, sistemaSi ucvleli saxiT darCa.

rac Seexeba iribnebs, isini Seicvala dgarebiT 2 da jvaredinad ganlagebuli iribnebiT 3.

dgarebi, romlebic ZiriTadaT iTviseben mkumSav Zalvebs xisti elementebisagan, profilebisagan aris damzadebuli. rac Seexeba jvaredinad ganTavsebul iribnebs, isini mocemul SemTxvevaSi gamWimavi Zalvebis aTvisebazea gaTvaliswinebuli ise, rogorc es iyo gau-Juravskis xeliTonis fermebSi.

iribnebi zeda sartyelze emagreba dgarebis Camagrebis kvanZebSi 4, romlebic ganTavsebulia zeda sartyelis centralur lilvebze 5, romelTa irgvliv brunavs zeda sartyelis pantografuli elementebi, romlebic, rogorc iTqva, gaSlili xidis mdgomareobaSi zeda sartyels warmodgens (fig. V.2)

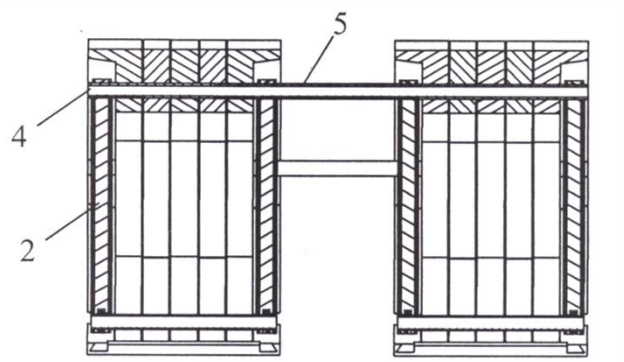


fig. V.2. – xidis konstruqciis ganivi, vertikaluri Wrili gamaval dgarze.

qveda sartyelTan 6, romelic mocemul SemTxvevaSi damzadebulia liTonis gaWimuli Reroebisagan, iribnebi aseve dgarebTan erTad aris Camagrebuli kvanZis 7 saSualebiT.

imis gami, rom sistemaSi iribnebi da qveda sartyelebi iTviseben mxolod gamWimav Zalvebs, maTi kveTis SerCevis dros aRar aris saWiro kveTis gazrda grZivi Runvis gaTvaliswinebiT.

xidis qveda sartyelebi boloebiT, cilindruli saxsrebiT Camagrebulia xidis sabjeni filebis 8 Tavze ganTavsebul lilvze 9, sadac aseve cilindruli saxsrebiT emagreba sartyelis boloebi (fig. V.3)

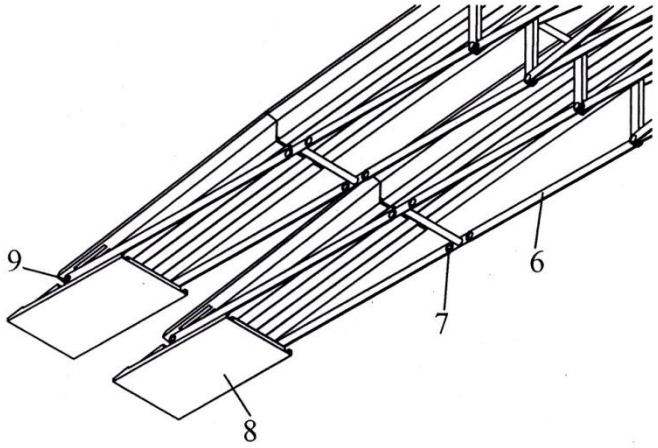


fig. V.3 – gasaSleli xidis sabjenebi

warmodgenili cvlilebebi mocemul sqemaSi aseve ZiriTadaT ganxorcielda imisaTvis, rom, jer erTi, mravalbagiriani qveda sartyeli Secvliliyo, rac iwvevda qveda sartyelis bagirebis araTanabar daWimulobas da, meore mxriv, im motiviT, rom gaadvilebuliyo sistemis dakecva.

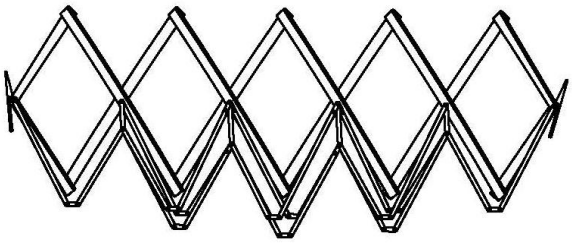
amisaTvis iribnebi da qveda sartyelebi warmodgenilia Rvedis tipis cilindruli saxsrebiT 10 da maT Soris mowyobili CanamatebiT 11 (fig. V.4).

amas garda, dakecvis sqemis realizaciisaTvis, iribnebi da qveda sartyelebi ganTavsebulia paralelur, erTmaneTis mimarT acilebul sibrtyeebze.

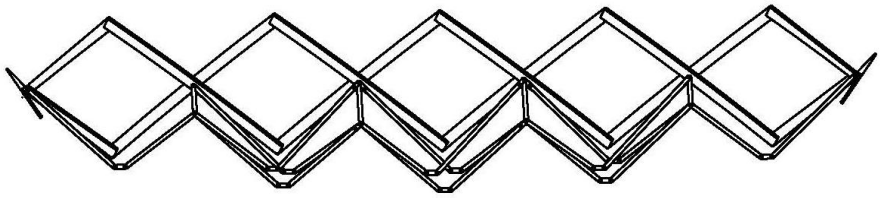
dakecili xidi xidgamdebze ganTavsdeba “dakecvis princips”+ + “daxvevis principiT” ganxorcielebuli xidis analogiurad.

analogiuria misi gadasalax winaaRmdegomaze gadebis mTeli procesi da xidgamdebidan moxsnis da xidgamdebze xelaxali gadebis sqemebi.

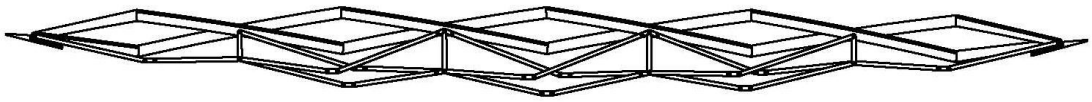
I etapi – xidi dakecil mdgomareobaSi



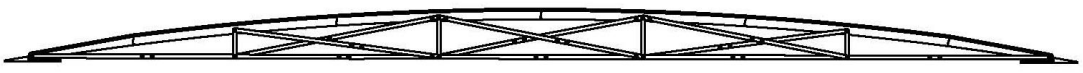
II etapi – xidis gaxsnis sawyisi faza



III etapi – xidis gaxsnis Sualeduri faza



IV etapi – xidis gaxsnis saboloo faza



V etapi – xidi gaSlil mdgomareobaSi

fig. V.4 – "dakecvis princips"+"dakecvis principiT" Seqmnili xidis transformaciis etapebi, gasaSleli xidis dakecili satransporto paketidan xidis srul gaSlamde.

V. 2. “dakecvis princips” + ”dakecvis principiT” Seqmnili, 48 metri malis mqone gasaSleli xidis gaangariSeba da konstruireba

gasaSleli xidis sigrZe Seadgens 48 metrs, awevis isari sabrjenebis donidan 1,981 metria, xidis siganea 4,1 metri. amasTan, xidis dakecili satransporto paketis simaRlea 3 metri. dakecili xidis paketis gabariti sigrZeSi 11,2 metria. gasaSleli xidis klasi tvirTamweobis mxriv aris MLC 70, rac samxedro xidebisaTvis Seadgens 70 tonas droebiTi sasargeblo tvirTis saxiT [35] [36] [37].

xidi mTlianad mzaddeba aluminis Senadnobisagan, konkretulad ki SenadnobiT, romlis markaa 1917T. misi saangariSo winaRoba Seadgens R_i=2000kg/sm^2. amasTan, drekadobis modelia E=710000 kg/sm^2, xolo Zvris modeli G=270000 kg/sm^2. *puasonis* koeficientia μ=0,3. xidis konstruqciuli masalis simkvrive ρ=2,7 t/m^3. temperaturisagan xazovani gafarToebis koeficientia K=0,23·10^{-4}.

xidis gaSlis xangrZlivoba Seadgens 7 wuTs. xidze moZravi datvirTva Seesabameba standarts _ HГ_60-s. xidis sakuTari wona winaswari miaxloebiTi angariSiT Seadgens 20t-s. xidis saangariSo sqema mocemulia fig. V. 5-ze.

xidis datvirTvebis sqemebi poziciebis mixedviT mocemulia cxrilSi 1, xolo Sesabamisi datvirTvis poziciisaTvis xidis konstruqciis CaRunvis da elementebSi Zalvebis da Zabvebis mniSvnelobebi, SerCeuli datvirTvebis kritikuli kombinaciebisaTvis, mocemulia crilSi V.2.

xidis gaangariSeba ganxorcielda programuli uzrunvelyofiT “Lira-2008”. saTanado angariSis Semdeg SeirCa kveTebi da jamuri specifikacia wonebisa, ris Sedegadac gasaSleli xidis saerTo woman miaRwia 19t-s. wonaSi gaTvaliswinebuli ar aris xidis damatebiTi konstruqciuli elementbis wonebi, romlebic aucilebelia misi normaluri eqspluataciisaTvis.

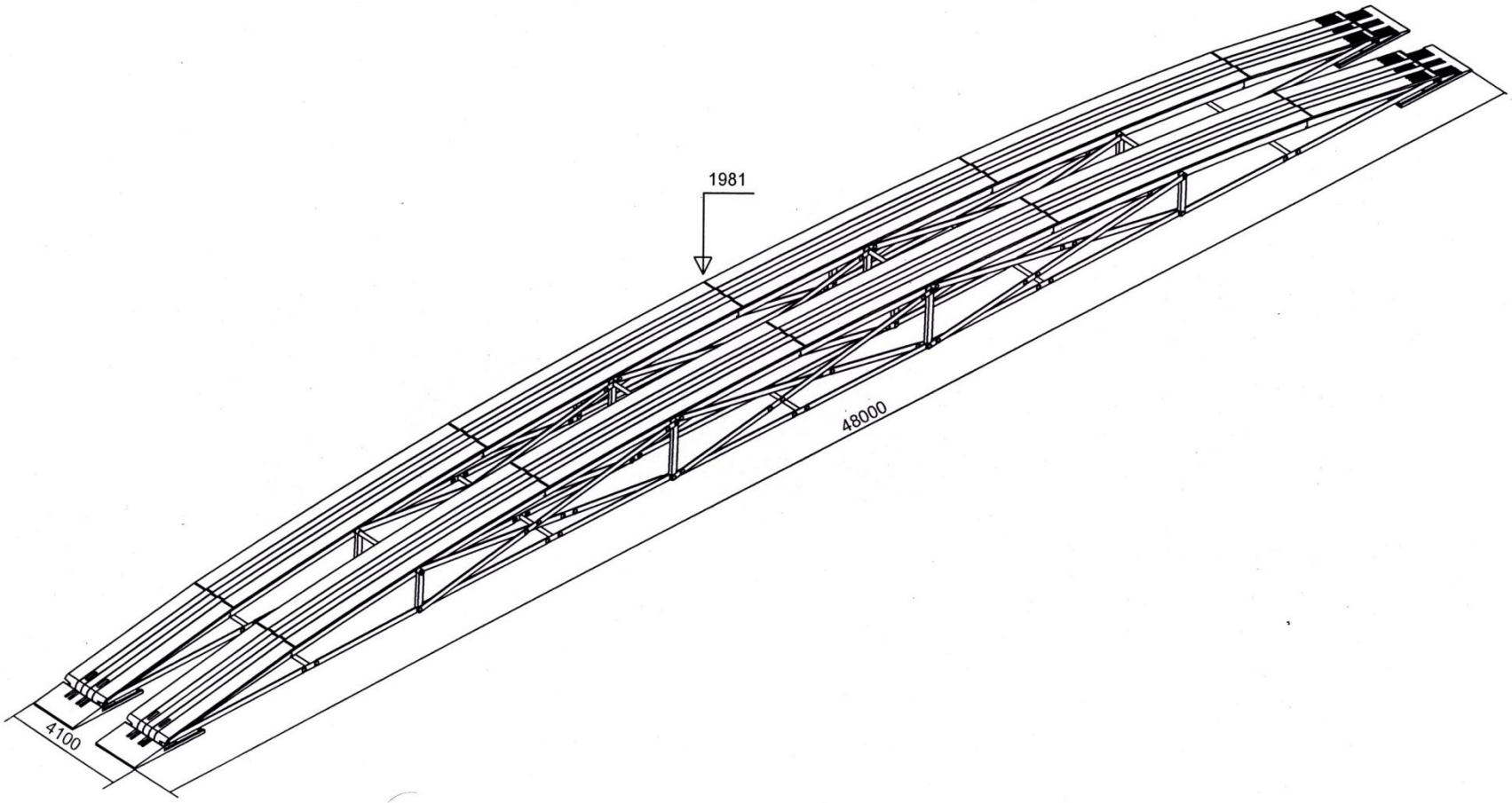
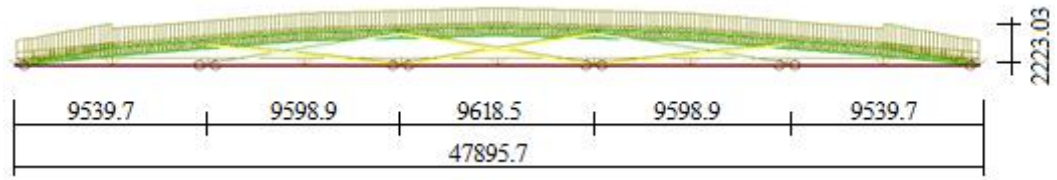
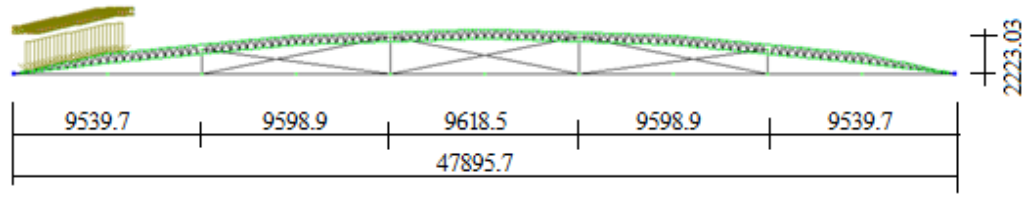
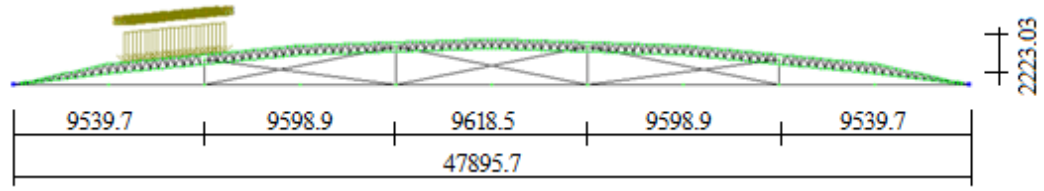
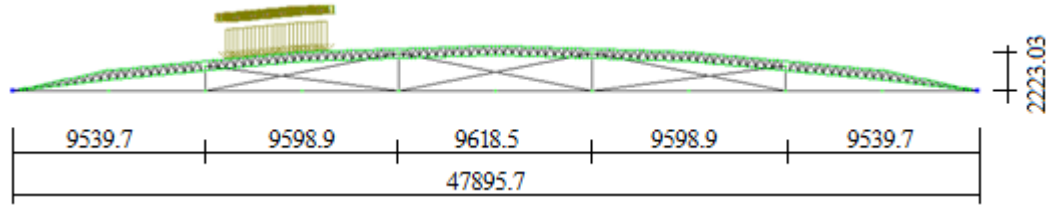
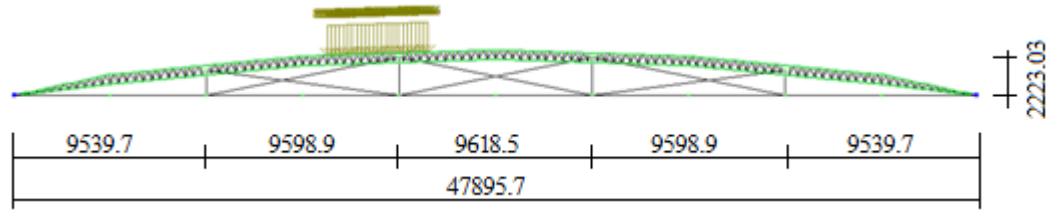
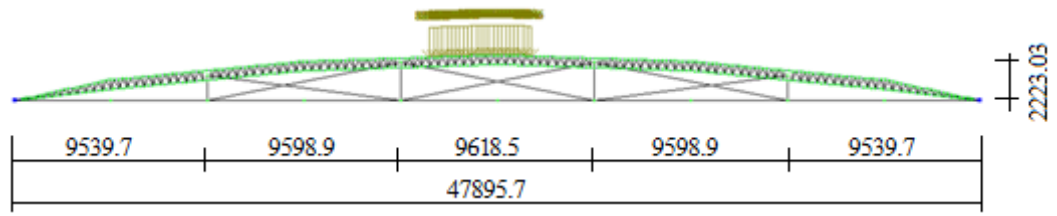
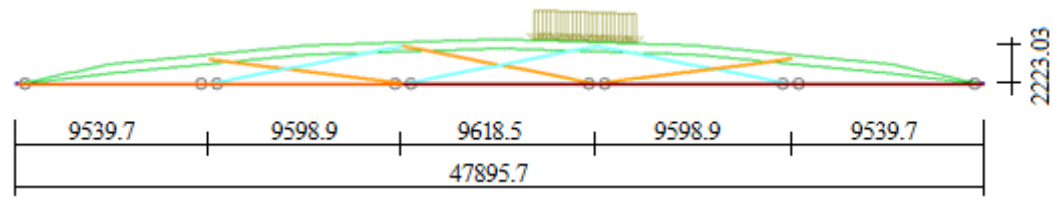


fig. V.5. gasaSleli xidis saerTo saangariSo xedi

cxrili V.1 – xidis datvirTvis sqemebi poziciebis mixedviT

#	**liandis datvirTvis sqemebi. datvirTvis klasi _ НГ-60**
1	
2	
3	
4	
5	
6	
7	

cxrili V.2 – xidis konstruqciis CaRunvebis da elementebSi Zalvebis da Zabvebis mniSvnelobebi

#	**maqsimaluri deformaciebis, Zalvebis da Zabvebis mniSvnelobebi**	**datvirTvis sqemebi**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	CaRunvebi (sm)	11.4	16.6	21.5	34.6	35.6	41.2	-
2	grZivi Zalvebi qveda sarTyelebSi (t)	13.27	34.0	66.6	76.6	65.0	71.5	64.25
3	grZivi Zalvebi ZiriTadi fermis gisosSi (t)	4.449	22.64	33.3	25.5	32.5	35.7	32.1
4	grZivi Zalvebi zeda sartyelis fermis gisosSi (t)	0.344 - 0.337	3.52 -3.296	2.851 -3.157	3.745 -3.773	2.894 -3.2	3.588 -3.624	2.315 -2.648
gaangariSeba konstruqciis muSaobiT drekad-plastikur stadiaSi								
5	grZivi Zabvebi qveda filaSi (t/m^2)	1481.2	20215.3	10974.9	10869.1	7771.0	8543.3	8623.6
6	grZivi Zabvebi zeda filaSi (t/m^2)	1578.8	18046.5	11272.4	14546.8	11044.3	14181.0	10147.7

miuxedavad garkveuli cvlilebebisa xidis konstruqciaSi kvlav SenarCunebuli iqna Semdegi dadebiTi da uaryofiTi Tvisebebi.

xidis dadebiTi Tvisebebi:

— xidis konstruqciuli sqema saSualebas iZleva gadailaxos 48 metri siganis winaaRmdegoba;
— xidi iSleba drois mcire monakveTSi;
— xidis gaSla warmoebs misi transformaciis procesSi adamianis Causvlelad;
— xidis wona 19 t.

amas daemata -

— xidis montaJis dros gaizarda xidis grZivi sixiste vertikalur mdgomareobaSi;
— xidis gaSlis meqanizmi gaSlis bolo etapze gadaiqceva xidis saval nawilad – fermis zeda kombinirebul sartyelebad;
— xidis didi ganivi sixiste;
— xidis gaSlisa da dakecvisaTvis SesaZlebelia ar iyos gamoyenebuli xidis energetikuli meqanizmebi.

xidis uaryofiTi Tvisebebi:

— xidis gaSla da dakecva SesaZlebelia mxolod da mxolod misi Sua wertilidan, rac aseve iwvevs xidgamdebebis samontaJo elementebis wonis zrdas;
— garTulebulia bolo etapze xidis kvanZebis Caketvis procesi, rac ar eqvemdebareba prognozirebad kontrols;
— xidis saval nawilSi gamoyenebuli SemaerTebeli kvanZebis zomebi SezRudulia, rac arasaimedos xdis maT muSaobas didi dinamikuri Zalebisa da dartymis dros;
— ver iqna miRweuli sasurveli suraTi qveda sartyelis elementebis daxvevisa da Semdgomi modernizeba dakecvis variantisa;
— gaizarda xidis satransporto paketis zomebi 11.4x4.0x3.4 m.

cxrili V.3 _ taqtikur_teqnikuri parametrebis Sedareba

პარამეტრები	FV4205 დიდი ბრიტანეთი	REMB USA	მძიმე სატანკო ხიდგამდები. საფრანგეთი	AVLB USA	HAB USA	"ბიბერი" გერმანია	ქართული პროექტი
ეკიპაჟი	3	2	3	2	2	2	2
ტვირთამწეობის კლასი	60 ტ	70 ტ	50 ტ	60 ტ	70 ტ	60 ტ	70 ტ
გაბარიტები							
სიგრძე	13.7 მ	16 მ	11.4 მ	11.8მ	16 მ	11.4 მ	11.2 მ
სიგანე	4.16 მ	4 მ	3.8 მ	4 მ	4 მ	4 მ	4.1 მ
სიმაღლე	3.9 მ	4.3 მ			4 მ		4.3 მ
სახიდე ფერმის საერთო სიგრძე		31 მ	22 მ	19 მ	31 მ	22 მ	50 მ
გადასალახი წინააღმდეგობის სიგანე.	22.9 მ		20 მ	18 მ		20 მ	48 მ
საერთო მასა	52.5 ტ	37.6 ტ	40 ტ	50 ტ	52 ტ	45 ტ	53 ტ
სახიდე ფერმის წონა	–	16 ტ	8 ტ	15 ტ	16 ტ	–	17 ტ
ხიდის წინააღ-მდეგობაზე გადების დრო	3 წთ	5 წთ	8 წთ	3 წთ	5 წთ	3-5 წთ	7 წთ
საბაზო ტანკი	ჩიფტენი	M1 აბრამსი	AMX-30	M60A1	M60A1	ლეოპარდი	M1 "აბრამსი" "ლეოპარდი" T-84
ვერტმფრენი	X	X	X	X	X	X	МИ-26ТМ СН-53Е

msoflioSi arsebuli "saieriSo" meqanizebul xidebTan, sadisertacio naSromSi ganxiluli "dakecvis pribcips" + "dakecvis principiT" Seqmnili gasaSleli xidis taqtikur_teqnikuri parametrebi mocemulia cxrilSi 3.

aRiSnuli naklovanebebis aRmofxvris mizniT damuSavda axali sqema xidisa.

V.3. gasaSleli xidis ormagi transformaciis – "dakecvis princips" + "teleskopis principiT" Seqmnili sqema

miuxedavad sxvadasxva variantebis Seqmnisa, romlebic iZlevian saSualebas 32÷48 metri malis mqone gasaSleli, saieriSo meqanizebuli xidebis Seqmnisa, formaTwarmoqmnis ormagi transformaciis principiT sxvadasxva kombinaciebisa, ver iqna miRweuli dakecili paketis simaRlis sagrZnobi Semcireba.

amdenad, daiwyo Zieba, gasaSlel xidebSi sufTa teleskopis principiT Seqmnili xidebis analogiebisa, rac SemdgomSi gaxdeboda safuZveli "dakecvis princips" + "teleskopis principiT" xidis konstruqciuli sqemis Seqmnisa [38] [39] [40] [41].

aRniSnuli sqemis mixedviT SemuSavda xidis konstruqcia, romelic warmodgenilia fig. V.6-ze.

konstruqcia Sedgeba or centralur savali nawilisagan 1, romlebic erTmaneTs ukavSirdeba cilindruli saxsariT 2, da romelSic ganTavsebulia kexi 3. TiToeuli savali nawili 1 Sedgeba ori liandisagan 4, xolo TiToeuli liandi warmoadgens damoukidebeli koWebis 5 grZivad ganlagebul rigebs. koWebi urTierTdakavSirebulia mxolod kexis nawilis 3 siaxloves. aRniSnuli koWebi 5, TiToeuli cal-calke, teleskopuri CasmiT, moTavsebulia ganapira savali nawilis blokebSi 6. aseTi ganapira blokebi aris sul oTxi cali. ganapira or-ori bloki xidis kexis mxares gaerTianebulia, xolo meore boloebi maT Tavisufali aqvT.

xidis konstruqcia qvemodan aRWurvilia moqnili iribnebiT 7, xisti dgarebiT 8, gamSleli mowyobilobebiT 9 da moqnili qveda sartyelebiT 10. xidis dakecvis dros yvela maTgani ganTavsdeba aseve dakecil mdgomareobaSi myof centralur nawilebsa da ganapira blokebs Soris.

xidis konstruqcia ganTavsdeba satanko xidgamdebze. igi damagrebulia xidgamdebTan erT-erT ganapira blokis saSualebiT. xidis gaSla gadasalax winaaRmdegobaze xdeba warmodgenili sqemis mixedviT (fig. V.7).

xidgamdebze 1 mowyobil uZrav baqans 2 gaaCnia gamosawevi da gruntze dasayrdnobi moZravi baqani 3, romelzec Camagrebulia hidrocilindrebi 4.

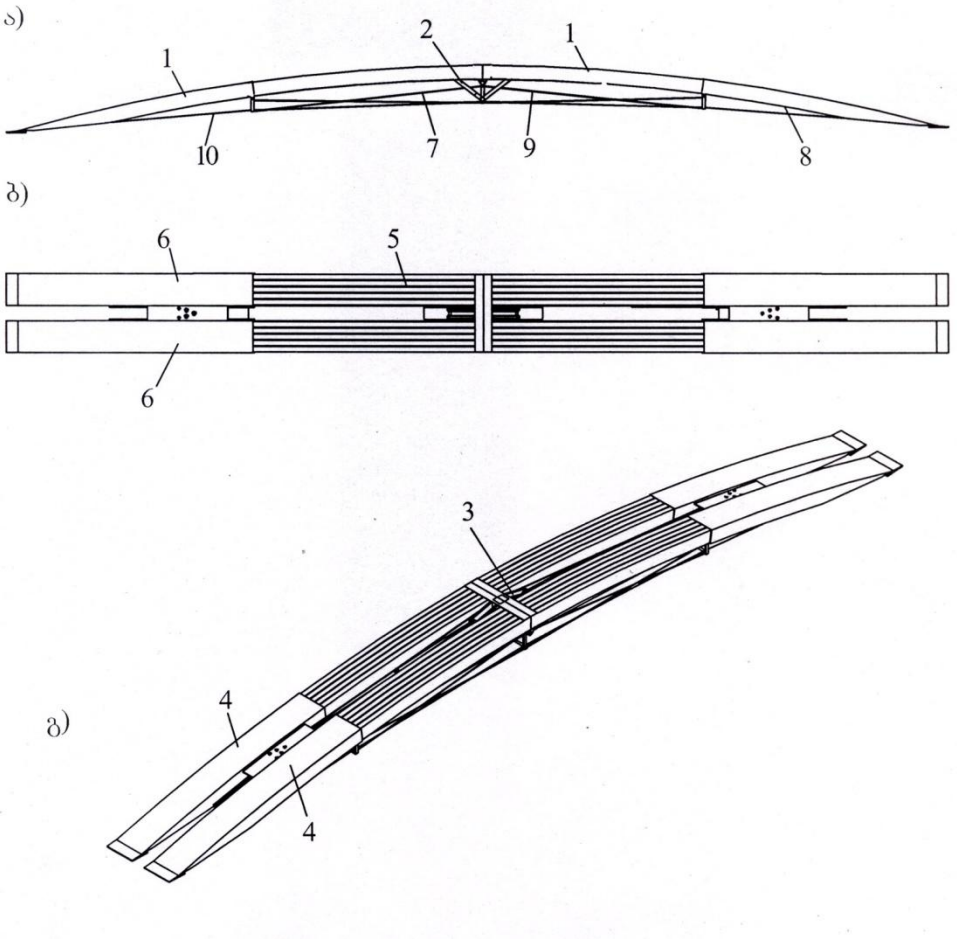


fig. V.6. gasaSleli xidis, “dakecvis princips”+”teleskopis principiT”, Seqmnili konstruqcia

a) xidis winxedi; b) xidis zedxedi; g) gaSlili xidis konstruqcia

hidrocilindrebis saSualebiT vertikalur mdgomareobaSi wamoiweva moZravi baqnis boloSi mowyobil RerZul cilindrul saxsarSi 5 Camagrebuli CarCo 6.

CarCosTan erTad vertikalur mdgomareobaSi modis RerZul cilindrul saxsarSi Camagrebuli moZravi isari 7, romelzec mimagrebulia gasaSleli xidis 8 ganapira lianda.

moZravi isars meore boloSi Cabmuli aqvs bagiri 9, romelic gadatardeba uZravi baqnis boloSi mowyobil gorgolaWze 10 da exveva jalambars 11 dolze 12, romelic xidgamdebze – tankzea mowyobili.

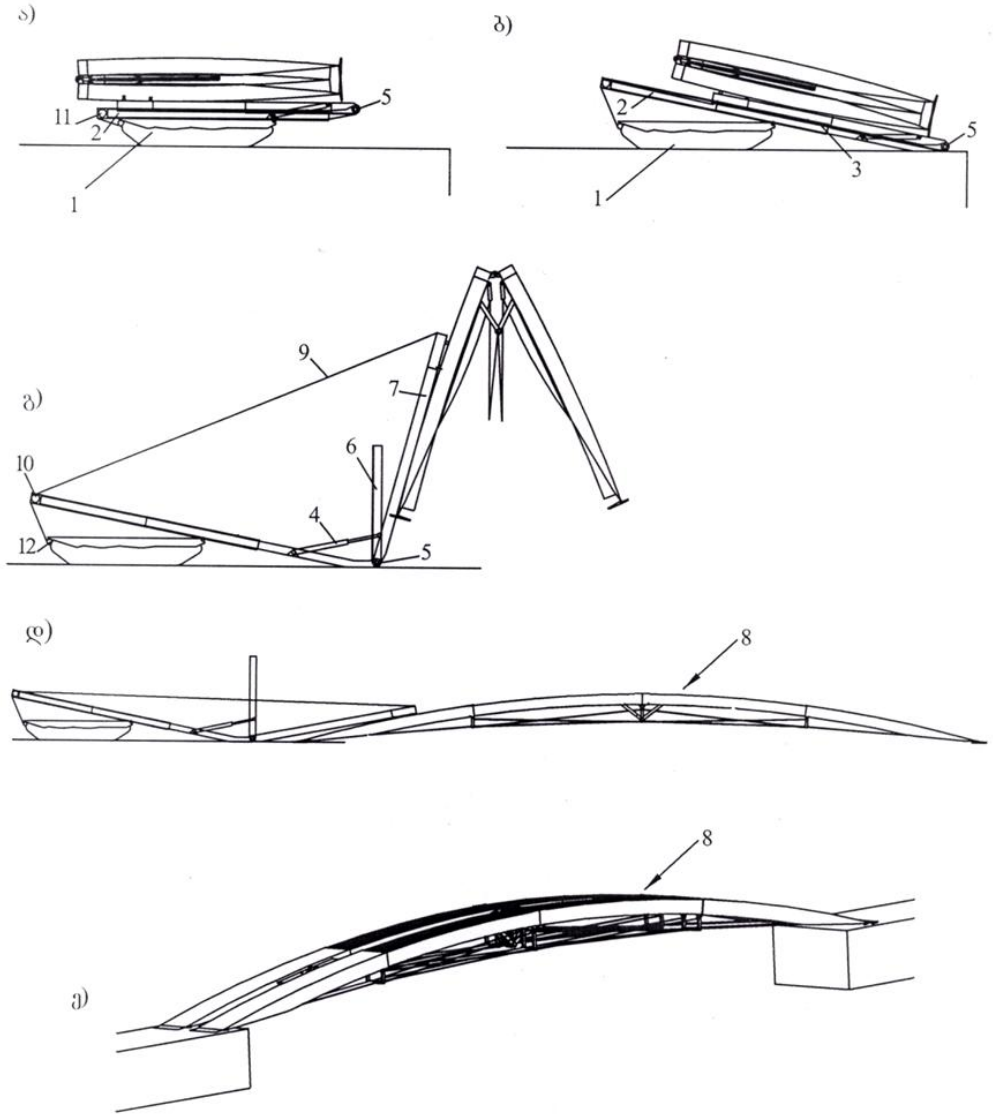


fig. V.7 – xidis dabrkolebaze gadebis transformaciis sqemebi.

a) xidgamdebi gasaSleli xidis satransporto paketTan erTad;

b) xidgamdebi moyvanilia mzadyofnaSi xidis gadasalax winaaRmdegobaze gasaSlelad; g) xidgamdebi xidis gaSlis sawyis momentSi; d) xidis gaSlis procesi; e) gasaSleli xidi saeqsploatacio mdgomareobaSi.

xidis konstruqciis dakecili paketis simaRlem, sxva gadawyvetebTan erTad, iklo 23_27% da 48 metri malis mqone xidisaTvis Seadgina 1,9÷2,1 metri. xidis wona dasaSvebis farglebSia da igi 32÷48 metri malebis SemTxvevaSi icvleba 17÷24 tonas Soris.

gansakuTreviT aRsaniSnavia xidgamdebis sqema _ misi moZravi baqani, romelic, erTi mxriv, zrdis manZils xidis sayrdenidan tankis sabjenis centramde, rac

aucilebelia xidis mdgomareobis SesanarCuneblad mis amoyiravebis sawinaaRmdegod da, meore mxriv, xidgamdebis mTliani konstruqciuli sqema gamartivebulia, rasac aseve ganapirobebs moZravi baqnis bolo nawilis dayrdnoba gruntze.

— xidis konstruqciuli sqema uzrunvelyofs, zemoT ganxiluli xidebis dadebiT TvisebebTan erTad, aseve, satransporto paketis simaRlis Semcirebas da igi mocemul 45÷48 metri malis SemTxvevaSi Seadgens 2 metrs.

— gansakuTrebiT aRsaniSnavia is, rom xidSi aRar aris gamoyenebuli mcire zomis da didi raodenobis cilindruli saxsrebi, xolo misi gaSla SesaZlebelia xidgamdebis mokle samontaJo nawilis ganapira blokSi CabmiT, rac amsubuqebs xidgamdebis konstruqciis wonas.

— xidis gaSla da dakecva xorcieldeba meqanizmebiT, romelTa energetikuli uzrunvelyofa xorcieldeba xidgamdebebidan.

— aRniSnuli xidebi Seswavlili iqna gaSlis da gaSlili procesebis daZabuli mdgomareobis mxriv, ramac daadastura xidebis Seqmnis realoba.

amdenad, SeiZleba gakeTdes daskvna imis Sesaxeb, rom SemdgomSi swrafadasagebi xidebis malis zrda SesaZlebelia mxolod da mxolod transformirebadi sainJinro sistemebis formaTwarmoqmnis martivi principebidan rTuli, ori an orze meti formaTwarmoqmnis principebis SeTavsebiT erT konstruqciul sqemaSi.

— amasTan, xidis konstruqciaSi garTulebulia teleskopuri liandebis erTmaneTSi Casma, romelic teqnikurad da teqnologiurad moiTxivs adgilobrivad kvaTebis sagrZnob momatebas. aseve xidis uaryofiT Tvisebad unda CaiTvalos liandis damoukidebeli koWebisagan Sedgena, rac moiTxovs koWebs Soris garkveuli sididis 7_70 santimetris Riobis datovebas.

— rac Seexeba transformaciis Sedegad formaTwarmoqmnis rTul – Sedgenil principebze dafuZnebuli konkretuli konstruqciuli sqemis optimalur variantis SerCevas, es ukve Semdgom amocanas warmoadgens.

V. transformaciis ormagi principiT agebuli gasaSleli xidebis konstruqciuli srulyofa da transformaciis sammag principze gadasvlis aucilebloba

V. 1. “dakecvis princips”+”daxvevis proncipiT” Seqmnili xidis Secvla “dakecvis princips” + “dakecvis principiT” Seqmnili transformirebadi xidiT.

Catarebulma Teoriulma da eqsperimentulma kvlevebma da gansakuTrebiT “dakecvis princips” + “daxvevis principiT” Seqmnili xidis sqemis konstruirebis logikam, wina planze wamowia is mimarTulebebi cvlilebebisa, romlebic gaamartiveben konstruqcias da Seamcireben misi dakecili satransporto paketis simaRles, rac esoden mniSvnelovania [32] [33] [34].

am mxriv, “dakecvis princips” + “daxvevis principiT” Semnili transformirebadi xidis sqemaSi (ix. fig. III.1 da fig. III.2) moxda Zireuli cvlilebebi xidis gisosis da qveda sartyelebis sqemebSi. amasTan, SenarCunebuli iqna zeda kombinirebuli sartyeli, romelic gasaSleli xidis formaTwarmoqmnisas ZiriTad funqcias asrulebs xidis transformaciis procesSi, xolo xidis gaSlis bolo etapze gadaiqceva savali nawilis mzid konstruqciad (fig. V .1).

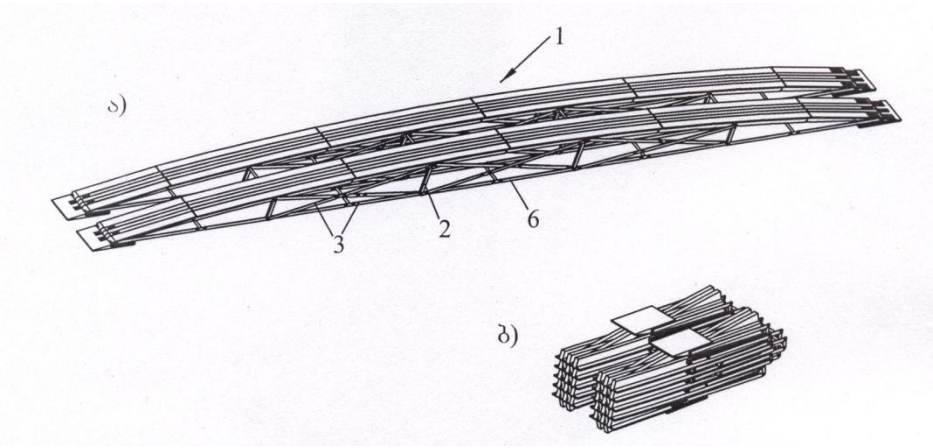


fig. V.1. - “dakecvis princips” + “dakecvis principiT” Seqmnili gasaSleli xidis konstruqciuli sqemebi.

a) gasaSleli xidis aqsionometriuli xedi;

b) xidis dakecili satransporto paketis xedi.

rogorc aRiniSna, gasaSleli xidis zeda sartyelebi 1, romlebic gaSlili xidis mdgomareobaSi saval nawils warmoadgenen, sistemaSi ucvleli saxiT darCa.

rac Seexeba iribnebs, isini Seicvala dgarebiT 2 da jvaredinad ganlagebuli iribnebiT 3.

dgarebi, romlebic ZiriTadaT iTviseben mkumSav Zalvebs xisti elementebisagan, profilebisagan aris damzadebuli. rac Seexeba jvaredinad ganTavsebul iribnebs, isini mocemul SemTxvevaSi gamWimavi Zalvebis aTvisebazea gaTvaliswinebuli ise, rogorc es iyo gau-Juravskis xeliTonis fermebSi.

iribnebi zeda sartyelze emagreba dgarebis Camagrebis kvanZebSi 4, romlebic ganTavsebulia zeda sartyelis centralur lilvebze 5, romelTa irgvliv brunavs zeda sartyelis pantografuli elementebi, romlebic, rogorc iTqva, gaSlili xidis mdgomareobaSi zeda sartyels warmodgens (fig. V.2)

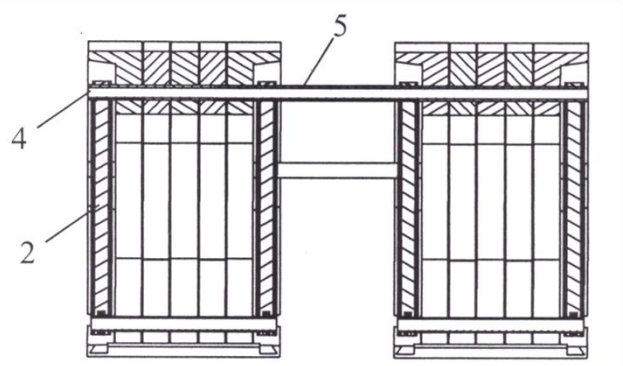


fig. V.2. – xidis konstruqciis ganivi, vertikaluri Wrili gamaval dgarze.

qveda sartyelTan 6, romelic mocemul SemTxvevaSi damzadebulia liTonis gaWimuli Reroebisagan, iribnebi aseve dgarebTan erTad aris Camagrebuli kvanZis 7 saSualebiT.

imis gami, rom sistemaSi iribnebi da qveda sartyelebi iTviseben mxolod gamWimav Zalvebs, maTi kveTis SerCevis dros aRar aris saWiro kveTis gazrda grZivi Runvis gaTvaliswinebiT.

xidis qveda sartyelebi boloebiT, cilindruli saxsrebiT Camagrebulia xidis sabjeni filebis 8 Tavze ganTavsebul lilvze 9, sadac aseve cilindruli saxsrebiT emagreba sartyelis boloebi (fig. V.3)

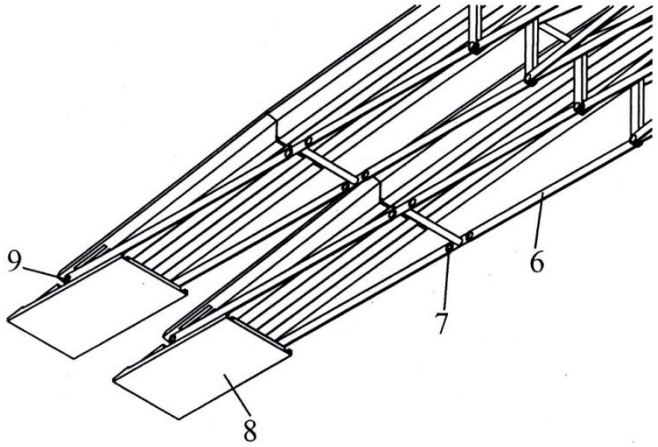


fig. V.3 – gasaSleli xidis sabjenebi

warmodgenili cvlilebebi mocemul sqemaSi aseve ZiriTadaT ganxorcielda imisaTvis, rom, jer erTi, mravalbagiriani qveda sartyeli Secvliliyo, rac iwvevda qveda sartyelis bagirebis araTanabar daWimulobas da, meore mxriv, im motiviT, rom gaadvilebuliyo sistemis dakecva.

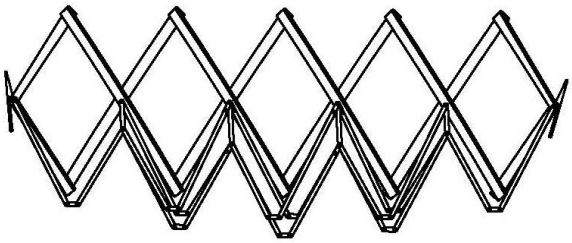
amisaTvis iribnebi da qveda sartyelebi warmodgenilia Rvedis tipis cilindruli saxsrebiT 10 da maT Soris mowyobili CanamatebiT 11 (fig. V.4).

amas garda, dakecvis sqemis realizaciisaTvis, iribnebi da qveda sartyelebi ganTavsebulia paralelur, erTmaneTis mimarT acilebul sibrtyeebze.

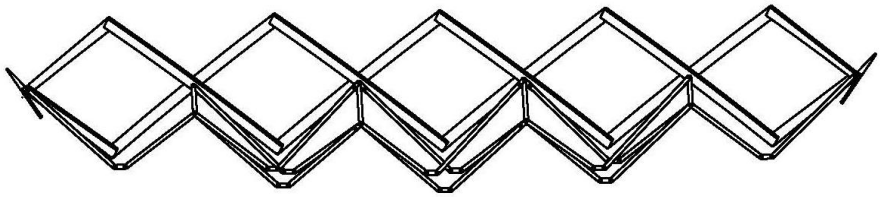
dakecili xidi xidgamdebze ganTavsdeba “dakecvis princips”+ + “daxvevis principiT” ganxorcielebuli xidis analogiurad.

analogiuria misi gadasalax winaaRmdegomaze gadebis mTeli procesi da xidgamdebidan moxsnis da xidgamdebze xelaxali gadebis sqemebi.

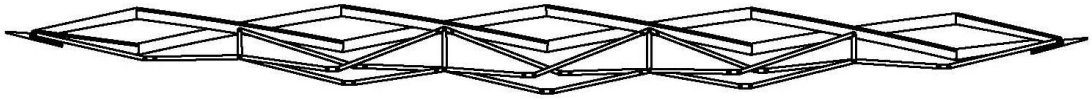
I etapi – xidi dakecil mdgomareobaSi



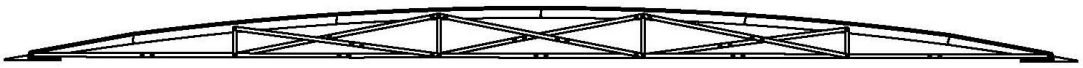
II etapi – xidis gaxsnis sawyisi faza



III etapi – xidis gaxsnis Sualeduri faza



IV etapi – xidis gaxsnis saboloo faza



V etapi – xidi gaSlil mdgomareobaSi

fig. V.4 – "dakecvis princips"+"dakecvis principiT" Seqmnili xidis transformaciis etapebi, gasaSleli xidis dakecili satransporto paketidan xidis srul gaSlamde.

V. 2. "dakecvis princips" + "dakecvis principiT" Seqmnili, 48 metri malis mqone gasaSleli xidis gaangariSeba da konstruireba

gasaSleli xidis sigrZe Seadgens 48 metrs, awevis isari sabrjenebis donidan 1,981 metria, xidis siganea 4,1 metri. amasTan, xidis dakecili satransporto paketis simaRlea 3 metri. dakecili xidis paketis gabariti sigrZeSi 11,2 metria. gasaSleli xidis klasi tvirTamweobis mxriv aris MLC 70, rac samxedro xidebisaTvis Seadgens 70 tonas droebiTi sasargeblo tvirTis saxiT [35] [36] [37].

xidi mTlianad mzaddeba aluminis Senadnobisagan, konkretulad ki SenadnobiT, romlis markaa 1917T. misi saangariSo winaRoba Seadgens R_i=2000kg/sm^2. amasTan, drekadobis modelia E=710000 kg/sm^2, xolo Zvris modeli G=270000 kg/sm^2. *puasonis* koeficientia μ=0,3. xidis konstruqciuli masalis simkvrive ρ=2,7 t/m^3. temperaturisagan xazovani gafarToebis koeficientia K=0,23·10^{-4}.

xidis gaSlis xangrZlivoba Seadgens 7 wuTs. xidze moZravi datvirTva Seesabameba standarts _ HГ_60-s. xidis sakuTari wona winaswari miaxloebiTi angariSiT Seadgens 20t-s. xidis saangariSo sqema mocemulia fig. V. 5-ze.

xidis datvirTvebis sqemebi poziciebis mixedviT mocemulia cxrilSi 1, xolo Sesabamisi datvirTvis poziciisaTvis xidis konstruqciis CaRunvis da elementebSi Zalvebis da Zabvebis mniSvnelobebi, SerCeuli datvirTvebis kritikuli kombinaciebisaTvis, mocemulia crilSi V.2.

xidis gaangariSeba ganxorcielda programuli uzrunvelyofiT “Lira-2008”. saTanado angariSis Semdeg SeirCa kveTebi da jamuri specifikacia wonebisa, ris Sedegadac gasaSleli xidis saerTo woman miaRwia 19t-s. wonaSi gaTvaliswinebuli ar aris xidis damatebiTi konstruqciuli elementbis wonebi, romlebic aucilebelia misi normaluri eqspluataciisaTvis.

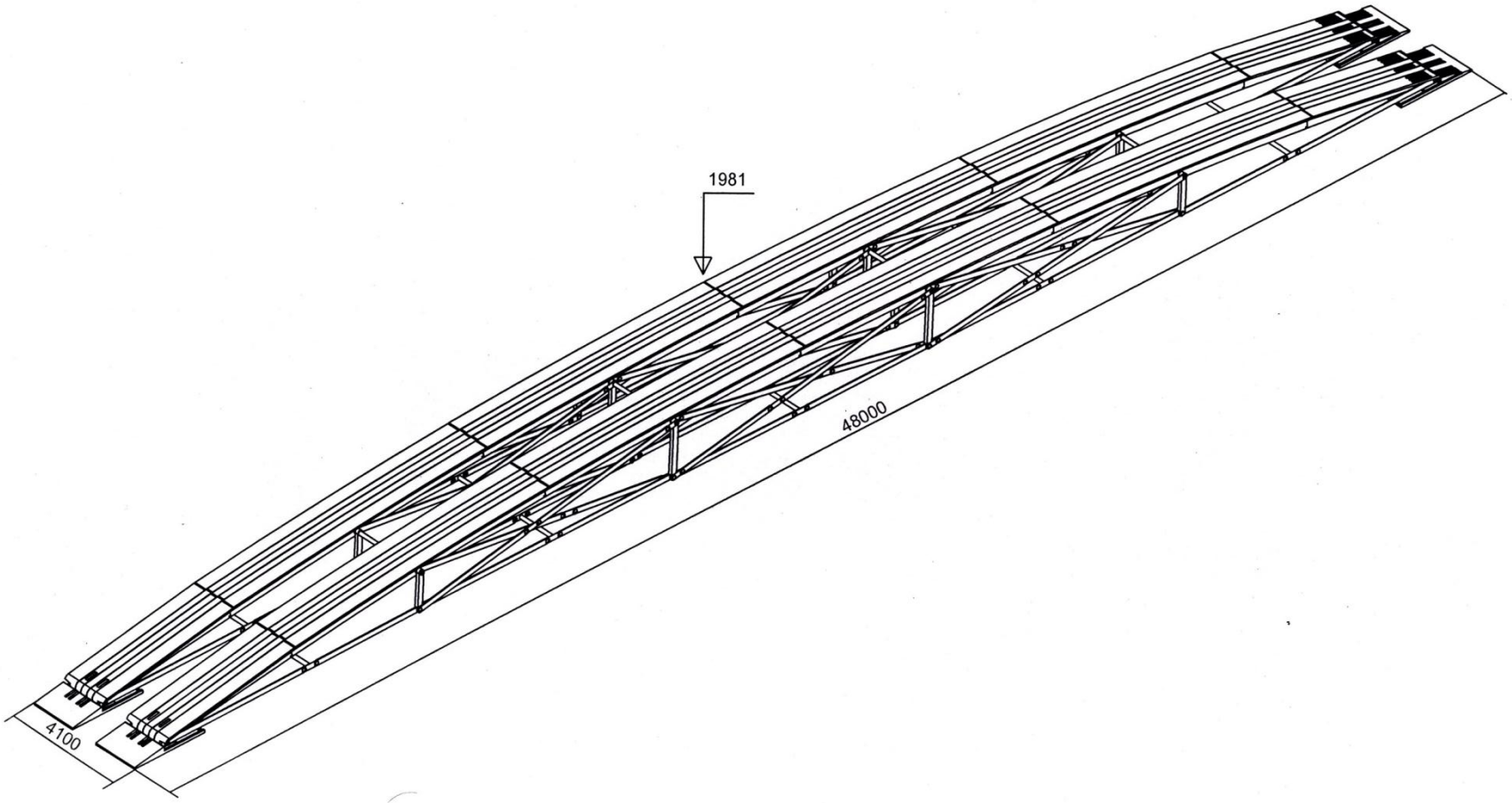
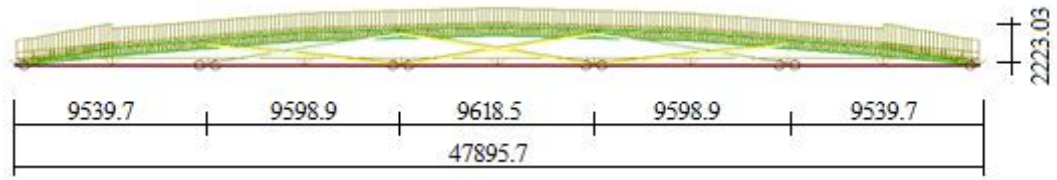
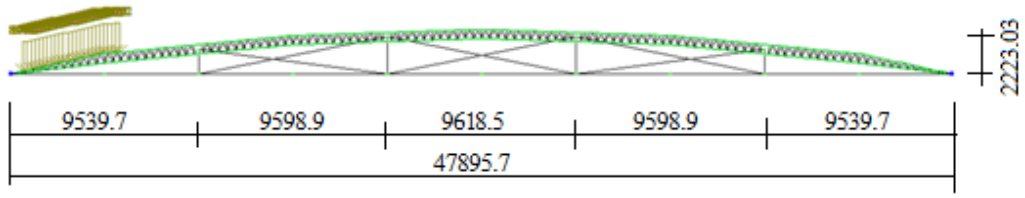
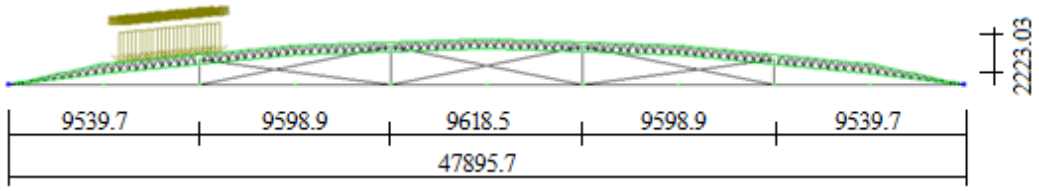
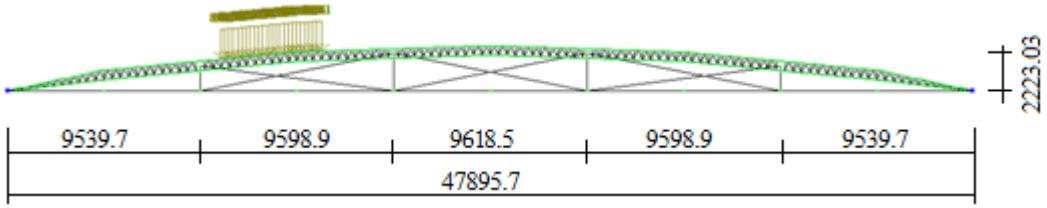
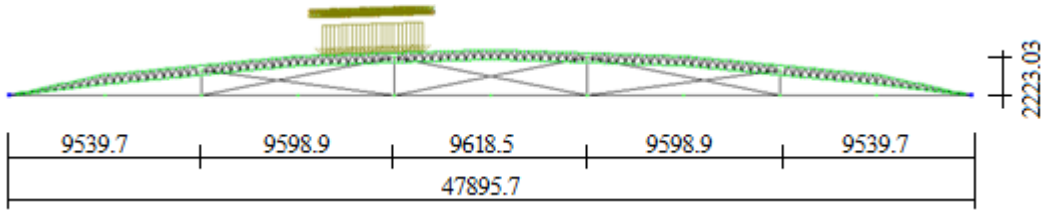
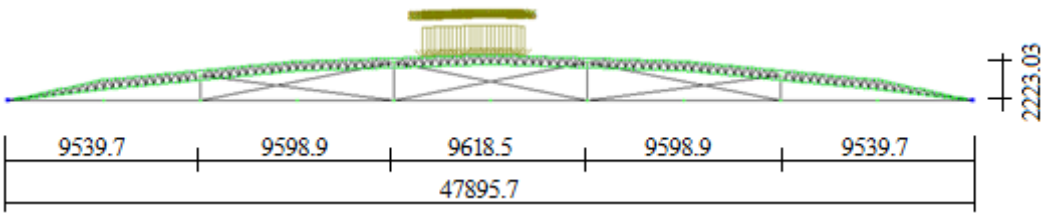
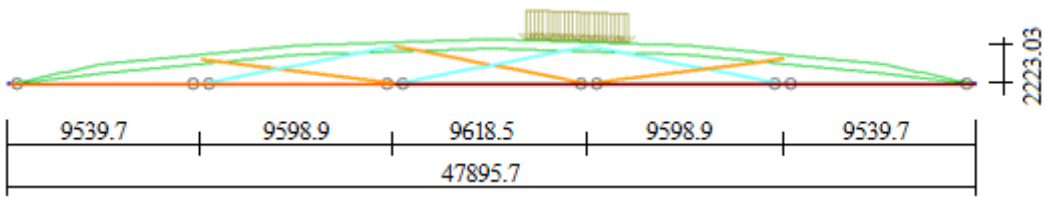


fig. V.5. gasaSleli xidis saerTo saangariSo xedi

cxrili V.1 – xidis datvirTvis sqemebi poziciebis mixedviT

#	**liandis datvirTvis sqemebi. datvirTvis klasi _ НГ-60**
1	
2	
3	
4	
5	
6	
7	

cxrili V.2 – xidis konstruqciis CaRunvebis da elementebSi Zalvebis da Zabvebis mniSvnelobebi

#	**maqsimaluri deformaciebis, Zalvebis da Zabvebis mniSvnelobebi**	**datvirTvis sqemebi**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	CaRunvebi (sm)	11.4	16.6	21.5	34.6	35.6	41.2	-
2	grZivi Zalvebi qveda sarTyelebSi (t)	13.27	34.0	66.6	76.6	65.0	71.5	64.25
3	grZivi Zalvebi ZiriTadi fermis gisosSi (t)	4.449	22.64	33.3	25.5	32.5	35.7	32.1
4	grZivi Zalvebi zeda sartyelis fermis gisosSi (t)	0.344 - 0.337	3.52 -3.296	2.851 -3.157	3.745 -3.773	2.894 -3.2	3.588 -3.624	2.315 -2.648
gaangariSeba konstruqciis muSaobiT drekad-plastikur stadiaSi								
5	grZivi Zabvebi qveda filaSi (t/m^2)	1481.2	20215.3	10974.9	10869.1	7771.0	8543.3	8623.6
6	grZivi Zabvebi zeda filaSi (t/m^2)	1578.8	18046.5	11272.4	14546.8	11044.3	14181.0	10147.7

miuxedavad garkveuli cvlilebebisa xidis konstruqciaSi kvlav SenarCunebuli iqna Semdegi dadebiTi da uaryofiTi Tvisebebi.

xidis dadebiTi Tvisebebi:

— xidis konstruqciuli sqema saSualebas iZleva gadailaxos 48 metri siganis winaaRmdegoba;
— xidi iSleba drois mcire monakveTSi;
— xidis gaSla warmoebs misi transformaciis procesSi adamianis Causvlelad;
— xidis wona 19 t.

amas daemata -

— xidis montaJis dros gaizarda xidis grZivi sixiste vertikalur mdgomareobaSi;
— xidis gaSlis meqanizmi gaSlis bolo etapze gadaiqceva xidis saval nawilad – fermis zeda kombinirebul sartyelebad;
— xidis didi ganivi sixiste;
— xidis gaSlisa da dakecvisaTvis SesaZlebelia ar iyos gamoyenebuli xidis energetikuli meqanizmebi.

xidis uaryofiTi Tvisebebi:

— xidis gaSla da dakecva SesaZlebelia mxolod da mxolod misi Sua wertilidan, rac aseve iwvevs xidgamdebebis samontaJo elementebis wonis zrdas;
— garTulebulia bolo etapze xidis kvanZebis Caketvis procesi, rac ar eqvemdebareba prognozirebad kontrols;
— xidis saval nawilSi gamoyenebuli SemaerTebeli kvanZebis zomebi SezRudulia, rac arasaimedos xdis maT muSaobas didi dinamikuri Zalebisa da dartymis dros;
— ver iqna miRweuli sasurveli suraTi qveda sartyelis elementebis daxvevisa da Semdgomi modernizeba dakecvis variantisa;
— gaizarda xidis satransporto paketis zomebi 11.4x4.0x3.4 m.

cxrili V.3 _ taqtikur_teqnikuri parametrebis Sedareba

პარამეტრები	FV4205 დიდი ბრიტანეთი	REMB USA	მძიმე სატანკო ხიდგამდები. საფრანგეთი	AVLB USA	HAB USA	"ბიბერი" გერმანია	ქართული პროექტი
ეკიპაჟი	3	2	3	2	2	2	2
ტვირთამწეობის კლასი	60 ტ	70 ტ	50 ტ	60 ტ	70 ტ	60 ტ	70 ტ
გაბარიტები							
სიგრძე	13.7 მ	16 მ	11.4 მ	11.8მ	16 მ	11.4 მ	11.2 მ
სიგანე	4.16 მ	4 მ	3.8 მ	4 მ	4 მ	4 მ	4.1 მ
სიმაღლე	3.9 მ	4.3 მ			4 მ		4.3 მ
სახიდე ფერმის საერთო სიგრძე		31 მ	22 მ	19 მ	31 მ	22 მ	50 მ
გადასალახი წინააღმდეგობის სიგანე.	22.9 მ		20 მ	18 მ		20 მ	48 მ
საერთო მასა	52.5 ტ	37.6 ტ	40 ტ	50 ტ	52 ტ	45 ტ	53 ტ
სახიდე ფერმის წონა	–	16 ტ	8 ტ	15 ტ	16 ტ	–	17 ტ
ხიდის წინააღ-მდეგობაზე გადების დრო	3 წთ	5 წთ	8 წთ	3 წთ	5 წთ	3-5 წთ	7 წთ
საბაზო ტანკი	ჩიფტენი	M1 აბრამსი	AMX-30	M60A1	M60A1	ლეოპარდი	M1 "აბრამსი" "ლეოპარდი" T-84
ვერტმფრენი	X	X	X	X	X	X	МИ-26ТМ СН-53Е

msoflioSi arsebuli "saieriSo" meqanizebul xidebTan, sadisertacio naSromSi ganxiluli "dakecvis pribcips" + "dakecvis principiT" Seqmnili gasaSleli xidis taqtikur_teqnikuri parametrebi mocemulia cxrilSi 3.

aRiSnuli naklovanebebis aRmofxvris mizniT damuSavda axali sqema xidisa.

V.3. gasaSleli xidis ormagi transformaciis – "dakecvis princips" + "teleskopis principiT" Seqmnili sqema

miuxedavad sxvadasxva variantebis Seqmnisa, romlebic iZlevian saSualebas 32÷48 metri malis mqone gasaSleli, saieriSo meqanizebuli xidebis Seqmnisa, formaTwarmoqmnis ormagi transformaciis principiT sxvadasxva kombinaciebisa, ver iqna miRweuli dakecili paketis simaRlis sagrZnobi Semcireba.

amdenad, daiwyo Zieba, gasaSlel xidebSi sufTa teleskopis principiT Seqmnili xidebis analogiebisa, rac SemdgomSi gaxdeboda safuZveli "dakecvis princips" + "teleskopis principiT" xidis konstruqciuli sqemis Seqmnisa [38] [39] [40] [41].

aRniSnuli sqemis mixedviT SemuSavda xidis konstruqcia, romelic warmodgenilia fig. V.6-ze.

konstruqcia Sedgeba or centralur savali nawilisagan 1, romlebic erTmaneTs ukavSirdeba cilindruli saxsariT 2, da romelSic ganTavsebulia kexi 3. TiToeuli savali nawili 1 Sedgeba ori liandisagan 4, xolo TiToeuli liandi warmoadgens damoukidebeli koWebis 5 grZivad ganlagebul rigebs. koWebi urTierTdakavSirebulia mxolod kexis nawilis 3 siaxloves. aRniSnuli koWebi 5, TiToeuli cal-calke, teleskopuri CasmiT, moTavsebulia ganapira savali nawilis blokebSi 6. aseTi ganapira blokebi aris sul oTxi cali. ganapira or-ori bloki xidis kexis mxares gaerTianebulia, xolo meore boloebi maT Tavisufali aqvT.

xidis konstruqcia qvemodan aRWurvilia moqnili iribnebiT 7, xisti dgarebiT 8, gamSleli mowyobilobebiT 9 da moqnili qveda sartyelebiT 10. xidis dakecvis dros yvela maTgani ganTavsdeba aseve dakecil mdgomareobaSi myof centralur nawilebsa da ganapira blokebs Soris.

xidis konstruqcia ganTavsdeba satanko xidgamdebze. igi damagrebulia xidgamdebTan erT-erT ganapira blokis saSualebiT. xidis gaSla gadasalax winaaRmdegobaze xdeba warmodgenili sqemis mixedviT (fig. V.7).

xidgamdebze 1 mowyobil uZrav baqans 2 gaaCnia gamosawevi da gruntze dasayrdnobi moZravi baqani 3, romelzec Camagrebulia hidrocilindrebi 4.

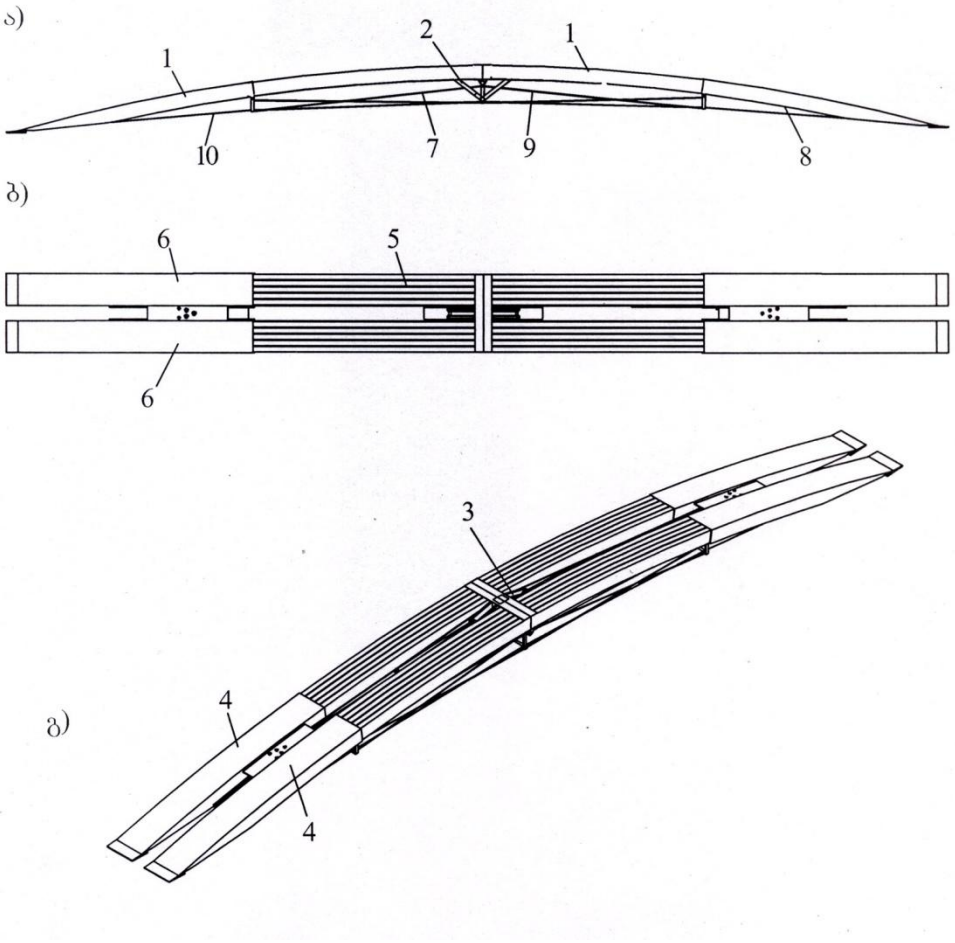


fig. V.6. gasaSleli xidis, “dakecvis princips”+”teleskopis principiT”, Seqmnili konstruqcia

a) xidis winxedi; b) xidis zedxedi; g) gaSlili xidis konstruqcia

hidrocilindrebis saSualebiT vertikalur mdgomareobaSi wamoiweva moZravi baqnis boloSi mowyobil RerZul cilindrul saxsarSi 5 Camagrebuli CarCo 6.

CarCosTan erTad vertikalur mdgomareobaSi modis RerZul cilindrul saxsarSi Camagrebuli moZravi isari 7, romelzec mimagrebulia gasaSleli xidis 8 ganapira lianda.

moZravi isars meore boloSi Cabmuli aqvs bagiri 9, romelic gadatardeba uZravi baqnis boloSi mowyobil gorgolaWze 10 da exveva jalambars 11 dolze 12, romelic xidgamdebze – tankzea mowyobili.

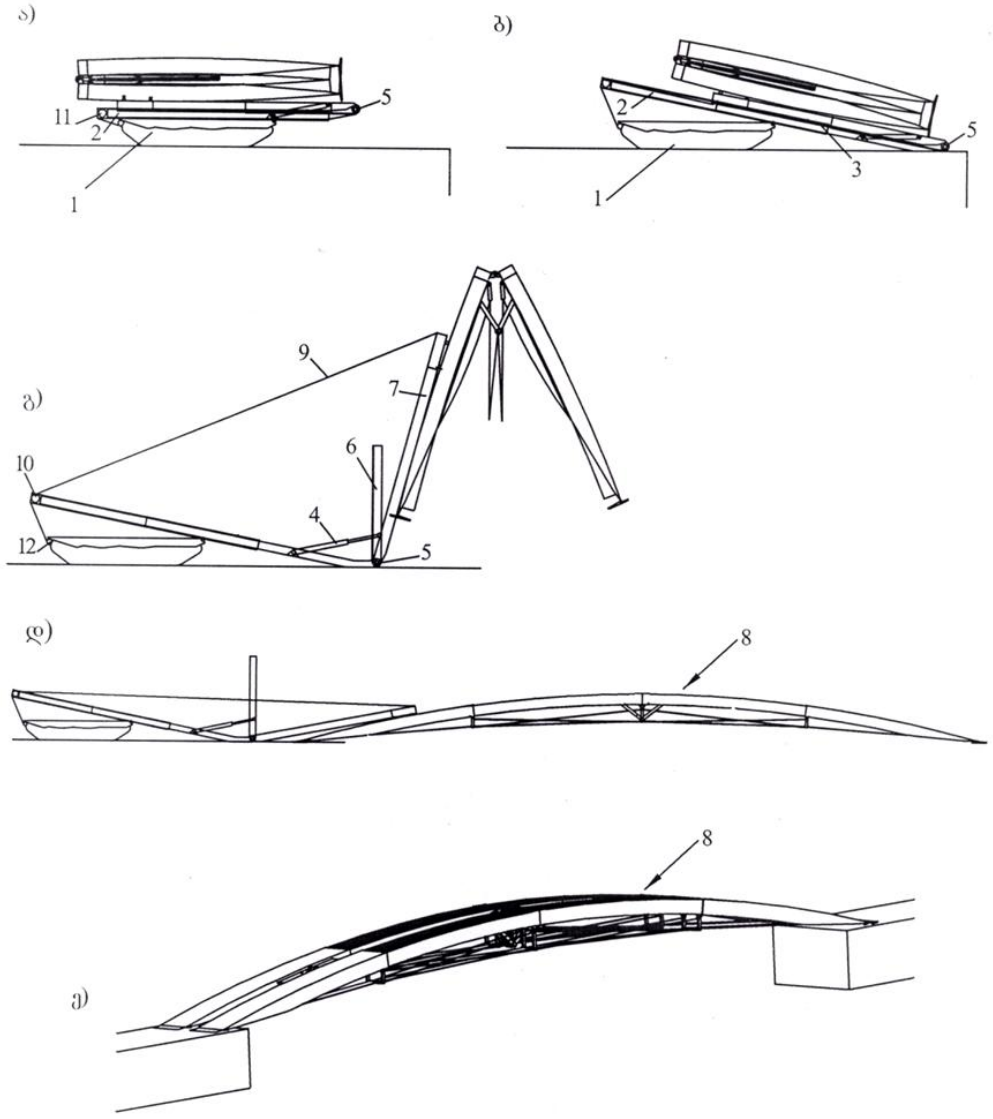


fig. V.7 – xidis dabrkolebaze gadebis transformaciis sqemebi.

a) xidgamdebi gasaSleli xidis satransporto paketTan erTad;

b) xidgamdebi moyvanilia mzadyofnaSi xidis gadasalax winaaRmdegobaze gasaSlelad; g) xidgamdebi xidis gaSlis sawyis momentSi; d) xidis gaSlis procesi; e) gasaSleli xidi saeqsploatacio mdgomareobaSi.

xidis konstruqciis dakecili paketis simaRlem, sxva gadawyvetebTan erTad, iklo 23_27% da 48 metri malis mqone xidisaTvis Seadgina 1,9÷2,1 metri. xidis wona dasaSvebis farglebSia da igi 32÷48 metri malebis SemTxvevaSi icvleba 17÷24 tonas Soris.

gansakuTreviT aRsaniSnavia xidgamdebis sqema _ misi moZravi baqani, romelic, erTi mxriv, zrdis manZils xidis sayrdenidan tankis sabjenis centramde, rac

aucilebelia xidis mdgomareobis SesanarCuneblad mis amoyiravebis sawinaaRmdegod da, meore mxriv, xidgamdebis mTliani konstruqciuli sqema gamartivebulia, rasac aseve ganapirobebs moZravi baqnis bolo nawilis dayrdnoba gruntze.

— xidis konstruqciuli sqema uzrunvelyofs, zemoT ganxiluli xidebis dadebiT TvisebebTan erTad, aseve, satransporto paketis simaRlis Semcirebas da igi mocemul 45÷48 metri malis SemTxvevaSi Seadgens 2 metrs.

— gansakuTrebiT aRsaniSnavia is, rom xidSi aRar aris gamoyenebuli mcire zomis da didi raodenobis cilindruli saxsrebi, xolo misi gaSla SesaZlebelia xidgamdebis mokle samontaJo nawilis ganapira blokSi CabmiT, rac amsubuqebs xidgamdebis konstruqciis wonas.

— xidis gaSla da dakecva xorcieldeba meqanizmebiT, romelTa energetikuli uzrunvelyofa xorcieldeba xidgamdebebidan.

— aRniSnuli xidebi Seswavlili iqna gaSlis da gaSlili procesebis daZabuli mdgomareobis mxriv, ramac daadastura xidebis Seqmnis realoba.

amdenad, SeiZleba gakeTdes daskvna imis Sesaxeb, rom SemdgomSi swrafadasagebi xidebis malis zrda SesaZlebelia mxolod da mxolod transformirebadi sainJinro sistemebis formaTwarmoqmnis martivi principebidan rTuli, ori an orze meti formaTwarmoqmnis principebis SeTavsebiT erT konstruqciul sqemaSi.

— amasTan, xidis konstruqciaSi garTulebulia teleskopuri liandebis erTmaneTSi Casma, romelic teqnikurad da teqnologiurad moiTxivs adgilobrivad kvaTebis sagrZnob momatebas. aseve xidis uaryofiT Tvisebad unda CaiTvalos liandis damoukidebeli koWebisagan Sedgena, rac moiTxovs koWebs Soris garkveuli sididis 7_70 santimetris Riobis datovebas.

— rac Seexeba transformaciis Sedegad formaTwarmoqmnis rTul – Sedgenil principebze dafuZnebuli konkretuli konstruqciuli sqemis optimalur variantis SerCevas, es ukve Semdgom amocanas warmoadgens.