

Added Values of the Local Timbers Materials for Main Bridge Frame Structures Utilizing Laminating Composites Technology



G's Ykxnr ffküs" s⁶¹/ I Lkur "s⁶ LXsfms Xkw knr kx NÖksx s⁷ IQn "k QÖ-RAffy⁶ IS kx ffÖu LkÖff⁶

6I süsvKx qsx oo" sx qJ ozk" w ox" 1Kx qsx oo" sx q LknÖffl[x süo "s" ffypXskÖlQkwz Ö-Hsx ka snffk R3NX Yyol "kx" k-QS 671 Voukx1 k"Öl7=7>8

7I süsvKx qsx oo" sx qJ ozk" w ox" 1Kx qsx oo" sx q LknÖffl[x süo "s" ffypGl nÖ"kl 1R3XskÖl tÖq Ty3<8 Voukx1 k"Öl7=7>6

GHYZ I Z@ oyl tom'sio-yp"r s-k"smo k"o"y -oou"r o yzzy"Ös"ff"y oxr kxno"r o ynkVQnyxo-sk"swl o"wk"o"skvzr ff-snkV z o"py"wkxno--oxnywzk-sx q"r o ywRAnk-' Öks"ffypÖÖkxn Q"swl o"-RÄr"r o S ynÖÖ-ypKk-"sna"ff-S UK. C: 155 2>155 S Vk. Ösffix q kw sk'on nywzy-s"o"onixywyqff"y l onyworsqr o"2nk-"swl o" Öks"ff-mk-Ö RÄr"r o S ynÖÖ-ypKk-"sna"ff -S UK.D6: 155 S Vk-y"rk"s"nxx l o Ö-on k-kx kv'o'xk"sio wk"o"skvpy"nyx-"Önsx q"r o l "snqo wksxp'kw o-"ÖnÖo--qs"no" l okw-. o-z onskwff py"r o Qn"kqs"s Nss"oqox nfflXskÖV"yüsx no l Qnyxo-sk3 s-"oqox nff xoon--öio"kv r Ök'on -wkwz wonsÖw l "snqo- py"nyxx on'sx q 75 ns-"sn-1 8> RÄn-1 kxn 6>> üsvkqo- Ösx q ynkV wk"o"skv- Önr k- ynkV"swl o"-3 s- vkwsk"sx q "onixywyqff s-xy" k xoRA"onixywyqff l Ö"r o Ösffix"syx yp"r s-"onixywyqff py"nyx-"Önsx q"r o wksx l "snqo-"ÖnÖo-s- nkvox qsx q kxn vsw'son"y"r o swz vov ox"kyx sx"r o nsüsvnyx-"Önsyx snÖ"skv-oniy"3 s-"Önff nywzy-on 7"ffz o-yp"r o ywRAnk-' Öks"ff-wm. yp"swl o"wk"o"skv--Önr k- Yr y"ok-z kxn Yr y"ok z ov'k'k Yffw. kxn 7"ffz o-yp wonsÖw mk-2 Öks"ff -wm. yx o--J sz"o"ynk"z Ö-kxn l kyzr ffwÖv. py"nyx-"Önsx q"r o wksx l "snqo-"ÖnÖo-3Hk-on yx"r o vld y"ky"ff"o-"o-Ö"- Ösffix q=5* ypuh wk"o"skv-kxn 75* wm yx o-1"r o o nywzy-s"o"swl o"wk"o"skv-wkff sx nffok-o"r o"swl o"-S UK l ff69: * "y 6; ; * p'yw"r o oTh"sx q S UK ükÖd yp"r o wm -yvn"swl o"-3Hk-on yx"r o -sw Ök"syx-"r o o vkw sk'on nywzy-s"o- RÄynox l "snqo qs"no"-7 Th<S Th5. w1"r o o"swl o"wk"o"skv-r kio zk-on kw"r o o"-kxn"r o kzz snk"syx yp"r s-"onixywyqff wkff swz"yüo"r o mh"swl o"ükÖd-kxn s"ny Ön l o Ö-on py" kx kv'o'xk"sio wk"o"skvyp"r o l "snqo qs"no"-wksx-"ÖnÖo-3

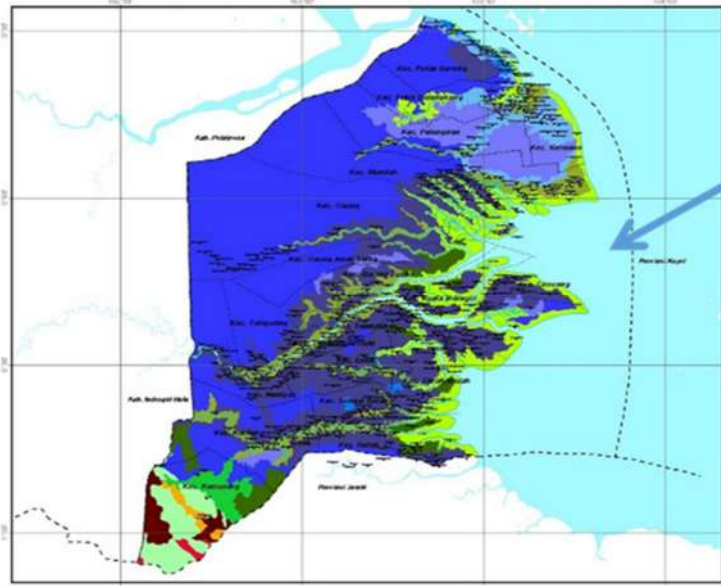
Qoff RÄn-dannon ükÖd-Inywzy-s"o-1"onixywyqfflkw sk"sx q1"swl o"-1qs"no"-1l "snqo-3

1. INTRODUCTION

Ö RÄ- "ozy"on"rk"r o qwl kv q"yRÄ sx"swl o" nowkxn RÄ- sx nffok-on p'yw 889 wswyx w⁸-756<. "y 896 wswyx w⁸-756=. -I kxknsx Ly"o-"QnÖ"ffl 756>.3 o "o" Ö"owox"yp"r o"swl o"wk"o"skv-ffz o mk-ÖÖ Y"ox q'r nk-ÖÖ k-on yx VQQÖ6>; 6 kxn YTO<><8@568. e6Tg sx Qnyxo-sk rk-l oox kv-y nyx"sx Öx q"y sx nffok-o e8Dg3Q Qnyxo-sk nÖsx q"r o 756; 2756< z o"syn-1"r o z"ynÖnsyx yp"swl o" yq-RÄ-o"swk'on k"95 wswyx w⁸ z o"ffok"3Q pkn1"r o oTh"sx q z vffRÄyn"swl o"1-kRA2"swl o"1 kxn z Öz sx nÖ"so-"o" Ö"on <: 3= wswyx w⁸ kxx Ökwff3Nox no l"r o o RÄ-k vkq yp8: 3=w⁸ voqkv"swl o" yq-z o"ffok"e8g3 o nonffok-o sx"r o k"ok yp"r o xk"Ökv py"o"-sx Qnyxo-sk k"r o k"o yp wy"o"r kx 75 wswyx r onff"o"-sx 756; 2756< nyx"yüo"skv RÄr kx sx nffok-o yp"swl o" yq-nowkxn3 o r sqr nowkxn kxn"r o vknü yp-Öz vffyp' Öks on kxn voqkv"swl o"wk"o"skv-r kio swz vnk"syx-py" sx nffok-sx q"r o r sqr 2 Öks"ff"swl o"z"sno-3Ly"o"Thwz vo"r o z"sno yp"r o"swl o" Öks"ff mk-ÖÖ Oz o" w⁸ sx XskÖz"yüsx no nÖ"ox"vff "okn on Xz391 55 155 2Xz3=1 55 155 1r ox no"r s-nkÖ-on"y sx nffok-o sx RÄynox l "snqo ny"-kxn kx sx nffok-o sx Ösx q swoqkv"swl o" yq-e8g3 o"swl o"mk-Ö kxn ÖÖz"sno-RÄ"o kl yÖ Xz371 55 155 z o" w⁸ 1 RÄn s-jk"vo--: 5* . "r kx"ry-o"r o Öks"ff mk-ÖÖ Ö-1"r o o RÄ-k xoon"y -oou kv'o'xk"sio"swl o"

"onixywyqff"y swz"yüo"r o ywRAnk-' Öks"ff"swl o"wk"o"skv- -mk-Ö kxn ÖÖ"y l onyworsqr 2nk-' Öks"ff yx o--mk-ÖÖ Ö kxn k" k y"nkl vo z"sno-l ff Ösffix q k nywl sk"syx yp"r o oTh"sx q ynkV"swl o"wk"o"skv-RÄn s-"ok"sio vff ywRA Öks"ff kxn "ok"sio vff nr okz o"z"sno-RÄr "ok"sio vff r sqr 2nk-' Öks"ff"swl o"-3 o-o nywl sk"syx"swl o"-wkff l o Ö-on k-"r o kv'o'xk"sio nyx-"Önsyx wk"o"skvyp"r o qs"no"l "snqo3Nox no"r s-nkx l o z o"py"won l ff"r o kzz snk"syx ypkw sk'on"swl o" nywzy-s"o"onixywyqff e: 1 g3 o vkw sk'on"swl o" nywzy-s"o"onixywyqff s-xy"xo RA l onkÖ-o"r s-"onixywyqff nywl sx o-wk"o"skv-"rk"RÄ"o wkno yp"RÄ y"wy"o"ffz o-yp"swl o"-rk"owksx -ozk"o kxn ns "ox" k"r o wknü-nyz smvotiov l Ö wonn kx snk wff nxx l o nyx-sno"on k-kx sx"oq"k'on nywzyx ox"e<2>g3 Ö s- sx"o"o"sx q"y sxüo"sqk"o"y RÄk"oThox"r s-nywzy-s"o"onixywyqff sx sx nffok-sx q"r o "ox q'r kxn z r ff-snkV z"yz o"so-yp"r o ywRAnk-' Öks"ff"swl o"-y l onyw o wonsÖw y"r sqr 2nk-' Öks"ff"swl o"-1 RÄn k"o Ö'swk"off"r o o nywzy-s"o"wk"o"skv- nxx l o Ö-on k-wk"o"skv-py"nyx-"Önsx q l "snqo qs"no"-e: g3 o"o-Ö"-yp

Received : Yoz"owl o" 5=17575 Revised : Un'yl o" 5917575 Accepted : Tyüowl o" 6817575



Lsq363Rynk"syx yp"r o-"Čhffk"ok sx Qn"kqs"sNss"1Qnyxo-sk3



Lsq373-k. Yry"ok-z1-l. Yry"okzovk"k Yffw1-m J sz"o"ynk"zÖ1-n. I kwzr ffwÖw

"r s-sxüo-"sqk"syx k"o oThomön wkffnyx"sl Öo"y"r ol ynfyp
 uxyRAñqo sx "r o k"ok yp nywzy-s"o wk"o"skv- py" "r o nsisv
 ox qsx oo"sx q nyx-"Čhñsyx sx nÖ"ffß

o-o k"smo yl tonšüo-k"o"y oThy"o"r o yzzy"Čks"ff
 py" ox r kxnsx q"r o knnon ükÖo-yp"r o yRAñk-" Čks"ffypÖÖ
 kxn Q"swl o" wk"o"skv-sx Qnyxo-skx lo-z onkwff sx Qn"kqs"s
 Nss"y l onywokr sqr o"žnk-" Čks"ffyx o-mk-Ö Ösffix q
 vkw ssk'on nywzy-s"o3 o oxn yp"r o "o-Ö" wk"o"skv-RAwl o
 -sw Ök'on"y l o Öon py"nyx-"Čhñsx q"r ol "snqo-wkx p'kw o
 -"ČhñÖo-3

o nk-o-"Čhffk"ok RA-wnk"on sx Qn"kqs"sNss"1XskÖ
 V'yüsx nöl Qnyxo-sk3 Gzz"yTsk"ovff >836* yp"r o k"ok yp
 Qn"kqs"sNss"Xoqox nff s-s"Čk'on yx "r o "süo" nozy-s" k"ok-1
 -RAwz1 kxn RA"vkn1 RA"r zok" -ysv kxn l "knus-r py"o"
 nyüo"sx q"r o nyk-" yp"r o Qn"kqs"s Xsüo"3 s- k"ok
 ox nywzk-o- 67; 69 uw RA"r kx küo"qko kv's"Čho yp 528
 wo"o"-kl yüo"r o wokx -ok vüoü3 o Qn"kqs"sNss" Xoqox nff
 r k-wkx ff "süo"-kxn"ry Ökxn-ypuw ypn's"n o-y"r k"r s-
 k"ok s- uxyRA k- yÖkxn J s'n o-Rkxn -Toqo"s Yo'sl Ö
 Vks". -y"r k"s"o" Čo-o-öüo"kv'r Čk'n"on l "snqo-o-z onkwff
 -wkz wonsÖw l "snqo- -vox q"r B 65 w. "y nyxxom 75
 ns-"sm-1 8> RA"n-1 kxn 6>> üwskqo-3 I ywwyxvfl "r o

-wkz wonsÖw l "snqo- RA"o nyx-"Čhñon Ö-sx q nyx nio"o
 wk"o"skv-"r k" RA"o oTho"sox non"y nywzk-o RA"r sx 72 ffo k"
 z o"syn-k-"r o o om ypyRA ok"sx q nkz kns"ff -ysv-y"r k"r o
 zok" -ysv- ny xy" r küo kx ff -Ö nox" l ok"sx q nkz kns"ff sx
 -Özy"sx q"r o nyx nio"o l "snqo py Čk'n"syx-3 o kzz vnk"syx
 yp wonsÖw 2r sqr 2 Čks"ff"swl o"- -mk-ÖÖ "y nyx-"Čhñ
 RA"nyox l "snqo- sx "r o-o k"ok-RA- oTho"sox nsx q ns nÖ"ff"y
 z Önk-k o voqkvffl kxn "r o ny-"- RA"o "ok"süo'ff oThox-süo3
 Noxnö "rs- s- swzy"lx" "y nyx-"Čhñ"r o l "snqo Ö-sx q
 yRAkxn wonsÖw ' Čks"ff"swl o"-r k" k'o kükskl vo wnkxvff sx
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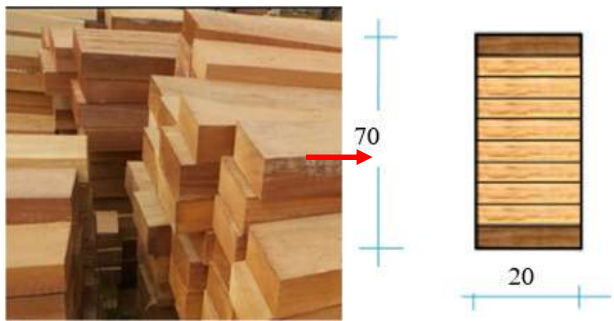
2. METHODOLOGY

o -kwzwo- yp"swl o" wk"o"skv RA"o yl "kx on nywo
 p'yw Qn"kqs"sNÖÖJ s-"sm1XskÖV'yüsx nöl Qnyxo-sk3 o
 "swl o" wk"o"skv-nyx-s" yp"swl o" mk-o-yp ÖÖÖ kxn Q 1
 KzyTff Xo-sx kxn Nk"nox o"1 "osx py"nsx q -r oo"- -wk". p'yw
 zy vff"yz ffoxo wk"o"skve65268g3

s-"Čhff nywzy-on 7"ffz o-yp yRAñk-" Čks"ff -wm.
 yp"swl o" wk"o"skv--Öm k- Yry"ok-z kxn Yry"okzovk"k
 Yffw. kxn 7"ffz o-yp wonsÖw žnk-" Čks"ff -wm. yxo-

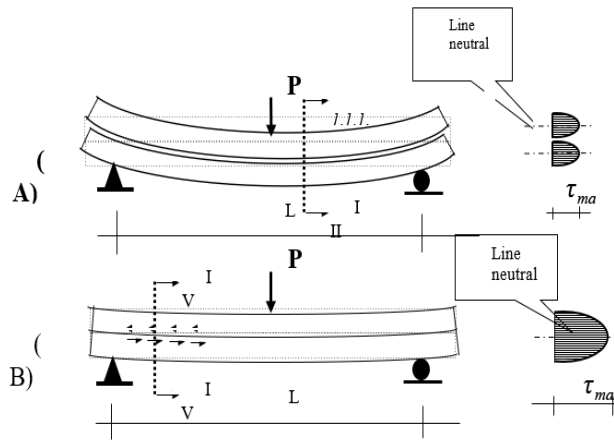
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Yk" o yp" r o k" - s" r o kzz vnk" syx yp" r o wRA wons Öv "swl o- r k- rs- y" snk vff l oox Ö-on k- xyx 2vksx nyx- "Önsyx wk" o skv- Öm k- z k" s syx- kxn" r o yy- "Öpkno3 s- "Öhff RA w o Tzwy" o" r o knnon ük Öv s" Ösxq" r o-o wk" o skv- k- k wksx - "ÖmÖkv wk" o skv py" l "snqo wksx p" kw o-3 Ö RA k- v- y knuxy RA onqon" r k" J sz "o ynk" z Ö s- uxy RA k- Qo "Ösxq kxn I kwzr ffw Öv s- uxy RA k- QÖk-3 Hy" r" swl o- k" o mk- s on k- pk- 2q" y RA q" "oo- kxn üo" ff "k" o" y lo kzz vson s" nyx- "Önsxq l "snqo p" kw o- "ÖmÖo-3 Nox no1" r s- "o- ok" nr - "Öhff w kff nr kwox qo" r o knknow snkz z "y kni o- s" x noüoyz s" x q k wRA 2nk- "swl o" wk" o skv" y l onywo r sqr 2nk- "swl o" wk" o skv- r k" nkx l o Ö-on k- k- "ÖmÖkv wk" o skv3



Lsq383-k. 3Zswl o" XkRA s k" o skv-1-1. G o" l osx q kw skk" on -y" r k" r o nswox -syx- nkx l ol sqqo" kxn wx qo"

Q" r s- "Öhff l" r o" o RA" o Ö-on 7" ffo- ypk nywzy- s" o yp "swl o" z vku- RA r k" k" sy yp 75* yp r sqr 2nk- "Öks" ff "swl o- -7" ffo- yp" swl o- - wons Öv 2r sqr 2nk- "Ö kxn" r o-o RA" o nywl sxon RA r =5* r o wRA 2nk- "swl o- -7" ffo- yp wRA 2nk- "Ö kxn Q" "Öks" ff 3 o-o "swl o" nywzy- s" o wk" o skv- RA" o r ox k kni on RA r ozy Tff "o- s" kxn r k" nox" o l -y" s" l onywo- k nywzy- s" o vksk k" on "swl o" y" q Öon kw skk" on "swl o- q Ökw. 3- Lsq Öo 8. 3

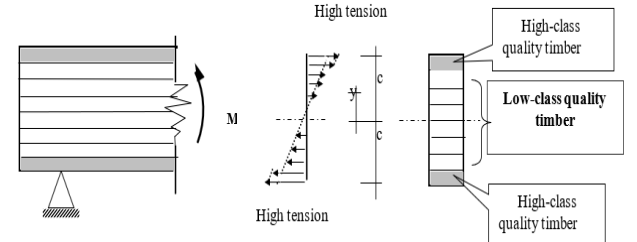


Lsq3 93 Ny" sffyx" kv Yr ok" Hokw- -G. ZRA 2Rkffo" Hokw- RA r y Ö Yr ok" Q" o knsyx kxn l- H RA r Yr ok" Q" o knsyx -

o swzy" kxn o yp swz" yüsx q" r o wRA 2nk- "Öks" ff yp "swl o" wk" o skv- s" y r sqr 2nk- "Öks" ff yx ol o- z onskvff py" nyx- "Önsxq l "snqo l okw- -r y Ön z k- "r o" o- "kxn k" n- yp

"r o- r ok" kxn o TÖ kv py" no- "o" kxn wkn- "o" l opy" o" r off nkx l o "onywwoxnon" y kzz vff s" r o nyx- "Önsyx sxn Ö" ff k" ok e69g3 o- r ok" py" no- r k" ym Ö s" r ol okw - "ÖmÖo nkx l o os" r o" üo" snk v" y" ry" sffyx" kv- r ok" py" no- l" r o wk Tzwy Öv ry" sffyx" kv- r ok" - "o- RA w ym Ö yx" r o x o Ö" kv k Tzwy" r o m y- 2- om syx yp" r ol okw e6: g3 ol or küsy" yp - r ok" - "o- o- s" r ol okw s- sw Ö" k" on s" r o py wy RA q q Ö o - q Ö o 9. 3

o nywzy- s" ol okw- nkx l o py" w on RA r RA ns o" ox" ' Öks" so- yp swl o- 3 o r sqr 2nk- "Öks" ff swl o- "o- ox" q" r RA- z vkn on yx" r o y Ö- sno- "r o" yz kxn" r o ly yw vffo- . l kxn" r o wRA 2nk- "swl o" RA- z vkn on k" r o sxx o" vffo- yp" r s- nywzy- s" o RA r wRA 2nk- "Öks" ff swl o- e; kg k- -r y RA s" x q Ö o: 3



Lsq3 : 3 l "y- 2- om syx yp M Ökw Hokw A- G. Ryxqs" Önsx kv l "y- 2- om syx l H Zox- syx J skq" kw l -I. Z" kx- üo" o- Yom syx

G o" r o" swl o" k w z w- RA" o q Öon RA r ozy Tff wk" o skv- r ox RA" o z" o- on oüox vff py" 79 r y Ö- - Lsq Öo; k l l 1m3 o- k w z w- RA" o kv- y" o- on py" r o snox" s nk" syx yp" r os" w on kx snk v" z "y z o" so- Ösxq k [x sio" kv Zo- sxq S kni sxo- - [ZS . - Lsq Öo; n l ol p 3 o- k w z w- RA" o z vkn on s" RA zyx s" - RA r k ns" kxn o yp yx o Zr s" n yp" r o "swl o" - z kx- 3 o non snk" on k w z w- RA" o wkn on q" kn Övff k" k nyx- kx" wksx q- zoon yp Ö" y 6= S V k s" 85 - onyx n- 3 ox "on Öm" r o wksx q- w RA r" y: S V k l" r ox sxn fok- o" r o wkn" y 6= S V k l kxn" r ox non fok- o" s" kq kx s" y: S V k J Ösx q" r o nff mo yp Ö" kxn 2ny RA wksx q" o- -1" r o no om syx- "r k" ym Ö s" x w- "r kx 65 - onyx n- n Ösx q" r o wksx q yp < S V k kxn 6= S V k RA" o "ony" non - Lsq Öo; p 3

Gmny" nsx q" y Nk" ff Mk" o" o" -756<. 1" r o" o RA- k - Öm o- -y" ff s" x o- kl v- r s" x q kx =9 w o" o- r sqr l Övnsx q Ösx q" swl o" - "Öm Öo- s"] soxx k l GÖ" sk e: g3 Nox no1" r o" o RA- k z" yüo- "r k" r o" swl o" ny Ön l o" r o wksx - "Öm Öo py" nsüs nyx- "Önsyx wk" o skv- k- wxq k- "r off z k- "r o wksx q" o- "kxn k" n- 3

S Ö r wksx xkr -7569. r k- nyxn Öm on k" o" "r k" "o- Ö" - s" r o nywz" o- sio - "ox q" r ük Öv yp vksk k" on RA yn noz ox nsx q yx" r o zy- s" syx yp" r o wkn yx" r o swl o" - Öpkno e6; g3 o nywz" o- sio - "ox q" r RA r" r o zy- s" syx yp" r o wkn z k" o s" r o wsnno yp" r o vksk k" on swl o" - Öpkno z "yn Öm- k r sqr o" nywz" o- sio - "ox q" r ük Öv nywz k" on" y vffsx q" r o wkn yx" r o onqo yp" r o vksk k" on swl o" - Öpkno 3

Ny RA üo" l s" RA- kv- y snox" s on" r k" r o vksk k" on "swl o" - w kff r kio - y w o RA kux o- o- s x m Önsx q" r s- w k" o skv k" o "ok" sio vff ok- ff" y nk Öo "o- 3 Nk" ff Mk" o" o" -756<. kxn S Ö r wksx xkr -7569. - "Öhff" o- on ük" sy Ö- n y- 2 kw sk k" on "swl o" - py" r o - "Öm Ökv nyw Öv x- kxn RA yn ox z kx ov- 3 o "o- Ö" - r y RA n" r k" r o wk" o skv- RA" o "ok" sio vff zyy" s" x "o- s" s" x q kx ff "o ym Ö" "ox no- k- "r ol or küsy" yp" r o knr o- sio Ö-on" y l sxn n y- 2 kw sk k" on s- z" yx o" y nk Öo "o- e6< 6= g



Lsq3; 3Zswl o“ Ykw zwo-kxn S onr kxsnkv”o-”sx qypkwxsk”on RÄyn -kw zwo-Ösx q k [ZS wknr sxo

Zkl vo 6 J k”kypS UKZo-”Xo-Ö?”-Hk-on yx YT C6828>; 526>>:

Ty	a yyn Zffzo	YkwzwoI yno	ToRÄyx -T.	J o omösyx -ww.	S UK-S zk.	K Güo“kqo	WÖks”ffl yno
6		QX26	:: 55	<3=	673=6		
7	J sz”o“ynk“z Ö-	QX27	8: 55	:	673>6	673><	K68
8		QX28	; 7: 5	=	683<6=		
9		QY26	<: 55	673	653 8:		
:	I kyzr ffwÖw	QY27	65555	68	683 5<	673 : 5	K68
;		QY28	=555	653	683>5=		
<		S X26	6955	8	=3>9		
=	Yry“ok-z	S X27	6=55	9	<3>57	<3>5;	K=
>		S X28	=55	7	<3>79		
65		S J 26	6; 55	; 3:	93 99		
66	Yry“okzov”k”k Yffw	S J 27	6=55	;	: 3 7=	: 3; 5	K;
67		S J 28	6: 55	:	: 3 7=		
68	I kyzr ffwÖw	QY2S J 26	9555	=3	=3 ; :		
69	Yry“okzov”k”k Yffw	QY2S J 27	8; 55	=	<3>57	=36:	K>
6:		QY2S J 28	: 555	65	=3<=5		
6;		QX2S J 26	8>55	;	66368		
6<	J sz”o“ynk“z Ö- Yry“ok-z	QX2S J 27	77: 5	9	>3<<	663>9	K65
6=		QX2S J 28	8: 55	:	673>6		

QXCJ sz”o“ynk“z Ö- Q”Öxq. ”swl o“AQYCI kyzr ffwÖw -QÖk-. ”swl o“IS XC Yry“ok-z -S o”kx”s S o”kr. ”swl o“AS J C Yry“okzov”k”k Yffw -S o”kx”s QÖsxq. ”swl o“

3. RESULTS AND DISCUSSION

s- "Öhff nyxnÖhñon ük"syÖ- "o"- py" nywzy-s"o kwxsck"on "swl o"- -qÖkw. Ösxq l oxnsxq kxn -r ok" "o"-3 ox "r o" "o-Ö"- RA"o -sw Ök"on Ösxq üor snno -"kxnk"n kTto wykn oxnywzk-sxq nokn wykn kxn vpo wykn3

836 Hoxnsxq Y^{mo} oxq"r Zo-Ö"-Xo-Ö"-

Hk-on yx "r o" "o"- "o-Ö"- py" "r o l okw oTÖkv "o"- -"opo""sxq "y "r o GYZS J 6982>9 -"kxnk"n. e6>g1s" RA-snox"s on "r k" r sqr 2mk- ' Öks"ff "swl o"- -Öm k- J sz"o"y^{nk}"z Ö- kxn I kyzzr ffvÖv - Qo"Öxq kxn QÖk-"swl o"- RA"o mk-s on k-K68 "swl o" ' Öks"ff nyxo ükÖb-3 S okx RAso py" wRA^{nk}- ' Öks"ff "swl o"- -Öm k- Yry"ok -z kxn Yry"ok zovk"k Yffw -S o"lx"s S o"kr kxn S o"lx"s QÖsxq "swl o" RA"o mk-s on k-K= kxn K; "swl o" ' Öks"ff yx o- "o-z omöüoff3

G nywl sk"syx yp 75* 2=5* I kyzzr ffvÖv - QÖk-, 2 Yry"ok zovk"k Yffw -S o"lx"s QÖsxq. Zswl o" nywzy-s"o- ffsnon k S UK yp =96: S zk -=96: 5 Qg 4 mw7.3 o nywzy-s"o nywl sk"syx yp J sz"o"y^{nk}"z Ö- Qo"Öxq Zswl o". 2 Yry"ok -z -S o"lx"s S o"kr. 75* 2=5* ffsnon kx S UK yp 666>9 S zk -666>95 uq 4 mw7.3

Hk-on yx "r o" "o"- "o-Ö"-yp Yry"ok zovk"k Yffw "swl o" k- w Öm k- =5* kxn 75* yp I kyzzr ffvÖv 1s" RA- yl "kx on "r k" r s- nywzy-s"o wkff sxmök-o s- -"oxq"r "y l onywo K> "swl o" ' Öks"ff nyxo -nywzk"on "y Yry"ok zovk"k Yffw -yxn "swl o" "r o"swl o" ' Öks"ff s-K; .3 o nywzy-s"o yp Yry"ok -z "swl o" =5* kxn J sz"o"y^{nk}"z Ö- 75* sxmök-on "r o"swl o" ' Öks"ff "y l onywo K65 -nywzk"on "y "r o" "o-Ö"- yp -yxn Yry"ok -z "swl o" "o"- "swl o" ' Öks"ff yp K=, 3 o "swl o" ' Öks"ff nyxo-yp K; 1K=1K>1kxn K65 RA"o l k-on yx VVQQ 6>; 6 nyxo-e6g3

Ö- s" nkx l o -Öwvk"sfion "r k" "r o"swl o" kwxsck"o nywzy-s"o "onm xyvyqff Ösüffix q wRA^{nk} r sqr 2mk- ' Öks"ff yp "swl o"-k-kl okw nywzy-s"o RA-kl vo "y sxmök-o "r o" oTÖkv -"oxq"r kxn wynÖÖ-ypok-"süff"yp "swl o" wk"o skvp"yw kx küo"qko yp: 5=5 S Vk - Yry"ok zovk"k Yffw. "y =96: S Vk -I ywzy-s"o. 1kxn p"yw kx küo"qko yp <k5: S Vk "y 666>9 S Vk k-r yRA^{nk} sx Zkl vo 6 kxn LsqÖo <3



Lsq3<3S UKZo- "Xo-Ö"-Hk-on yx YT Ö828>; 52

Zkl vo 6 kxn LsqÖo < "k"on "r k" "r o" S UK yp kwxsck"on nywzy-s"o "swl o" wk"o skv- -RA^{nk} k z"zy""syx yp 75* J sz"o"y^{nk}"z Ö-kxn =5* Yry"ok -z. sxmök-on l ff6; * p"yw "r o" oTö"sxq -yxn Yry"ok -z "swl o" S UK3 o nywl sk"syx

yp75* I kyzzr ffvÖv "swl o" RA^{nk} Yry"ok zovk"k Yffw "swl o" nyÖn sxmök-o "r o" S UK -"oxq"r l ff69: * p"yw "r o" oTö"sxq -yxn Yry"ok zovk"k Yffw "swl o"3

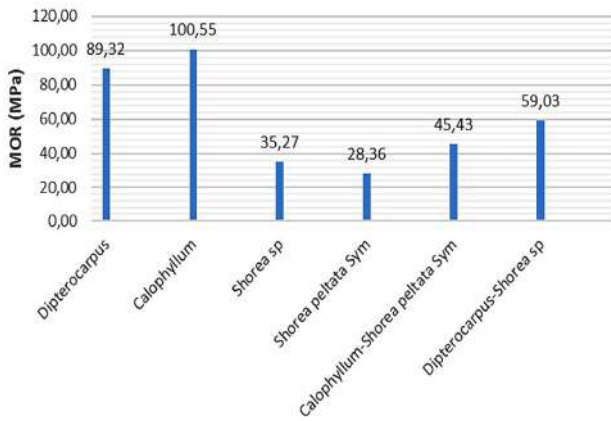
Hokw oTÖkv "o"- "o-Ö"- "opo""sxq "y GYZS J 6982>9 k"o qoxo"kwff yl "kx on py" J sz"o"y^{nk}"z Ö-kxn I kyzzr ffvÖv "swl o" l Yry"ok -z l kxn Yry"ok zovk"k Yffw RA^{nk} r küo k wk"m l o"RA^{nk} "r o" S ynÖÖ- yp Kk-"süff" -S UK kxn S ynÖÖ- yp Xsqns"ff -S UX. -"oxq"r l RAso "r o" S UX -"oxq"r yp I kyzzr ffvÖv "swl o" s- r sqr o" "r kx "r k" yp J sz"o"y^{nk}"z Ö- "swl o" yxo3 Ö nkx l o -"k"on "r k" "r o" nyx"msl Ösyx ypr sqr o"2mk- ' Öks"ff "swl o"-s- üo"ff nywxsck" k omösxq "r o" nÖhso l orküsy" kxn oTÖkv -"oxq"r yp "r o" "o"-on nywzy-s"o "swl o" l okw-3 Ö- s" nkx l o -Öwvk"sfion "r k" kx sxmök-o sx S UK kxn S UX -"oxq"r- yp "r o-o kwxsck"on nywzy-s"o "swl o"- s- sqxs nkx" kxn nkx l o "onywwoxnon "y kzzvff k- "r o" wksx -"Öm"Öo py" l "sqo qš"no" wk"o skv- -Zkl vo 7 kxn LsqÖo =, 3

Zkl vo 7 kxn LsqÖo = -r yRA^{nk} k" "r o" J sz"o"y^{nk}"z Ö-kxn I kyzzr ffvÖv "swl o" oTÖkv "o"- r küo k nÖhso xk"Öo z o"py" wknö RA^{nk} nkx l ok" "r o" ok" süoff vk"qo -"o-2""kx py"no-3

Yry"ok -z kxn Yry"ok zovk"k Yffw k"o wy"o vsuoff"y l o wy"o l "s w l kxn wRA^{nk} sx l ok"sxq -"o-2""kx wykn3 G o" nywz"o-sxq nywz"o-syx wykn "o"- RA"o nyxnÖhñon "r o-o l y"r "swl o"-RA"o nkwxqo RA^{nk} sx -swsk" k ok-k" "r o" Öz o" -sno yp "swl o" vkffo--LsqÖo-> kxn 65. 3

Zkl vo 7J k"ky pS UX Zo- "Xo-Ö"-Hk-on yx GYZS J 6982 >9

Ty	a yyn Zffo	Ykwzvo I yno	S UX -S zk	S UX Güo"qko -S zk
6		QX26	=; 3=	
7	J sz"o"y ^{nk} "z Ö-	QX27	<83 >	=>37
8		QX28	65<3>	
9		QY26	<=38	
:	I kyzzr ffvÖv	QY27	65; 3=	6553 :
;		QY28	66<3:	
<		S X26	863<5	
=	Yry"ok -z	S X27	893 =	8: 3<
>		S X28	8>3 7	
65		S J 26	7<3>	
66	Yry"ok zovk"k Yffw	S J 27	893;	7=3;
67		S J 28	7739	
68	I kyzzr ffvÖv	QY2S J 26	9>3=	
69	Yry"ok zovk"k Yffw	QY2S J 27	8; 3=5	9: 38
6:		QY2S J 28	: 536	
6;		QX2S J 26	; 536;	
6<	J sz"o"y ^{nk} "z Ö- Yry"ok -z	QX2S J 27	: 53 9	: >38
6=		QX2S J 28	; ; 37>	



Lsq3=3S UX Zo-” Xo-Ö-”-Hk-on yx GYZS J 6982>93

No	Figure	Information
A		Calophyllum - Shorea peltata Sym Composite Timber Damage Model
B		Dipterocarpus - Shorea sp Composite Timber Damage Model

Lsq3>3Zffz o yp”swl o” kxn nywzy-s”o nkwwqo

o “o-Ö-”- yp”ro Yry“ok zov”k”k Yffw” swl o” l okw -=5* . ”o-” nywzy-s”on R&R I kyzzr ffwÖw” swl o” -75* . -ryRA” r k” ro wynov ypnkwkqo -”k”on ”y ynmÖ” k” ro l y yw vkffo” yp”ro Yry“ok zov”k”k Yffw” swl o” l ox s” RA- pywRA” l ff” ro ”ook-o ypk vkffo” yp”ro qvÖn” swl o” r k” -z”okn-kyxq RA” ro” swl o” vkffo”--LsqÖo; . 3

o “o-Ö-”- yp” oTÖkv”o”-sxq y p J sz”o” ynk”z Ö” swl o” nywzy-s”o-yp75* y” 64: zk” RA” Yry“ok-z” swl o” -=5* . yl”kxon” ro” ffz o yp” oTÖkvnkwwqo” ffz o RA”o” ro” sx”skv nkwwqo ynmÖ”on yx” ro l y yw Qo”Öxq” swl o” l o” k- -ryRA” sx LsqÖo Hk-on yx” ro” o-Ö-”-yp”ro S UX” o-” kxn wyknzho om”syx” ok”syx-rsz q”kzr -ryRA” k” ok”süovff vk”qo sxmök-o sx nopy”wk”syx kxn nÖmsö l or küsy”-l”rs-s-nÖ” y” ro nyx”s l Ösyx yp” r sqr 2 Öks”ff” swl o” vkffo”- -J sz”o” ynk”z Ö-kxn I kyzzr ffwÖw. RA”snr k”o wy”o”-swox” nywzk”on ”y wyRA” Öks”ff” swl o” -z onso-3 o nkwwqo k”ok- RA”on”kRA” sx LsqÖo >3

83/ Yr ok” Y”oxq”r Zo-” Xo-Ö-”-

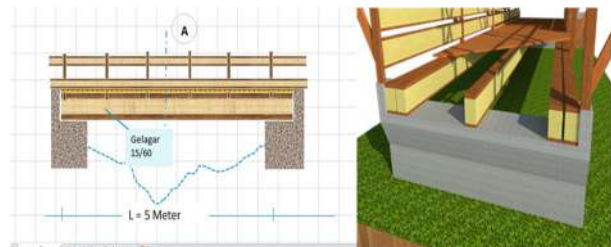
Zo-”- yp” swl o” vkwsxk”on -snxq l ynm-” r k” RA”o nywzson Ösxq” RA” ffz o-ypknr o-süo- -KzyTffl yxn H”kxn knr o-süo l k-on yx KzyTffl kxn I “y-2 yxn b9 l k-on yx V] Gl yxo- r küo ffsowon” ro pywyRA”q” o-Ö-”-Zkl vo 8. 3

Hk-on yx Zkl vo 81k- RA”wk- LsqÖo 65 s” nkx l o-”k”on ”r k” ro” o-Ö-”-yp”ro -rok” -”oxq”r ”o-” o-Ö-”-py” ro J sz”o” ynk”z Ö-kxn Yry“ok zov”k”k Yffw” swl o” ffz o-k”o vsoqs2 l vo py” KzyTffl yxn kxn I “y-2 yxn b9 knr o-süo” ffz o-1RA”so py” ro I kyzzr ffwÖw kxn Yry“ok-z” swl o” ffz o-ny xy” woo” ro” o’ Ö”owox”-3Ly” qvÖxq Ösxq l “y-l yxn b9 knr o-süo- k”o vsoqs l vo py” kw”ffz o-yp”ro” o-”on” swl o”--LsqÖo 65. 3

No	Figure	Information
A		Shorea sp Laminated Shear Test Results using Crossbond X4 Adhesives
B		Shorea peltata Sym Shear Lamination Test Results using Crossbond X4 Adhesives

Lsq3653Zswl o” -r ok” kxn vkwsxk”syx” o-”3

Q”rs-”Öff RA”ynox l “nqo wynovsxq RA” nk”son yÖ” y z”yüsnö k -swz vo no-sqx no-m”sz” syx ypk 65 w -ry” -z kx RA”ynox l “nqol-z kx RA” r l-H 73k: w lqs”no” -ffo” C 53k wAl C 53 w -nyÖ vo qs”no” <5475 mw 7. 1”swl o” nox-s”ff=55 uq 4 w 81 yy” r smux o-@538 w l”ro x Öwl o” yp qs”no” 9 z sonö- LsqÖo 66. 3



LsqÖo 663S ynovH”snqo kxn” swl o” l “nqo qs”no”-

H”snqo Y”mÖ”o l kvnÖk”syx Gxkuff-s-@

J k”k sxz Ö”@

Roxq”r ypYz kx lR @5 w

o RA”r yp”ro l “nqolH”@3k: w

Yffo y pqs”no”

@ C 53k wAl C 53 w - o qs”no” Öo- k nyÖ vo <5475 qs”no” l okw-

Yz ons mM”küs”ff

@55 uq 4 w 8 -Rkl ”o-”-

Lwy” r smux o-@

538 w

T Öwl o” y pqs”no”-

@ z sonö-

63J okn wykn-kxn vsüo wykn-3

J okn Rykn-

Zswl o” -”mÖkvwykn

Cr Th Tffswl o” -z ons mq”küs”ff C53k w T53 w Tff55 uq4w⁸ C779 uq4w

H”snqo Lwy” a osqr”

C”swl o” -z ons mq”küs”ff ThH49. Th”swl o” r smux o- C=55 uq4w⁸ Th73k: 49. T5 58 w C6; 1 uq4w

Zy”kvl” snqo nokn wykn- C7951: uq4w

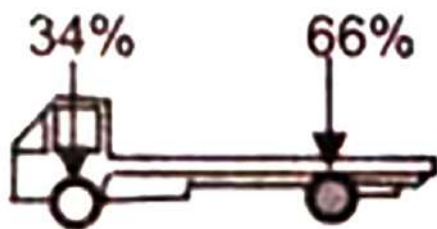
Rsüo wykn-

Vyx” wykn- RA” r ro k-Övz”syx-yp z wykn- C 93; ”yx -Hk-on yx” ro ; ; * yp”ro o’ Öükvox” -sx qvokTff wykn -py” ok” RA”oovoTffv” Ömwykn. yp63/ R RA” r ro” y”kv” Öm RA”sq” yp ; 3 ”yx RA”- ; * Th3 ”yx C93; ”yx. -Lsq367. 3

Zkl wo 8 J k"kyx Yr ok" Y"oxq"r Zo" Xo-Öp-

Ty	Zffz o ypGnr o-sio	a yyn Zffz o	YkwzvoI yno	Yr ok" Y"o— -S zk.	Yr ok" Y"o— Güo"qko -S zk.	WÜks"ffI yno
6			QX26	6; 3=		
7		<i>J sz"o"ynk"z Ö-</i>	QX27	>3:	693=	K68
8			QX28	6; 3 6		
9			QY26	939		
:		<i>I kyzzr ffwÖw</i>	QY27	73=	836	K68
;	Kzy Tff		QY28	937		
<			S X26	738		
=		<i>Yr y"ok-z</i>	S X27	836	837	K>
>			S X28	836		
65			S J 26	; 39		
66		<i>Yr y"ok z ov"l"l Yffw</i>	S J 27	; 3:	: 3;	K=
67			S J 28	83>		
6			QX26	: 39		
7		<i>J sz"o"ynk"z Ö-</i>	QX27	673<	; 39	K68
8			QX28	536		
9			QY26	93<		
:		<i>I kyzzr ffwÖw</i>	QY27	; 3:	: 38	K68
;	I "y-l yxn b9		QY28	: 3 =		
<			S X26	835		
=		<i>Yr y"ok-z</i>	S X27	739	: 38	K>
>			S X28	>3:		
65			S J 26	93=		
66		<i>Yr y"ok z ov"l"l Yffw</i>	S J 27	=39	; 3=	K=
67			S J 28	; 38		

o küo"qko" Öm "y"kvwykn-sx Qn"qqs"s Nss"1756> Rävzk—
"r o nonsnk"onl "snqo RA-; 3"yx



Lsq3 673 J s"sl Ösyx yp "ro kTff wykn- -p"yx" kxn "ok"
RAoov- 3

[xspy" w ' wykn yp53=5 "yx4w -y" =55 uq4w "swl o" -z ons m
q"küis"ff

Lwy" RAooyr ol "snqo B: w l"r ox @
z wykn-C93; "yx nkx ' wykn-C53=5 "yx w

-r ynu ny o nsox"
J s"knø l o"RAox qs"no"1-

] or smo wykn--J wykn.
k3Vysx" wykn-

Zy"kvwykn - 6; Rsüo Rykn-

l 3[xspy" w ns"sl Öon wykn-

Zy"kvRykn- 63J R.063 RR.

o"y"kv l "snqo nokn wykn
Rsüo Rykn] or smo Rykn - RyknJ . - 63J R.063 RR.

C 6388
C536<w
Cz Th r ynu ny o 1Th
C93; T6388 T536<
C: 38 "yx : 88838 uq
C 63 Th 88838 C =1 8838 uq
=: 88838 Tw
C' Th r ynu ny o 3Th
C53=5 T6388 T536<
C53= "yx ><3= uq4w
C 61: 839 uq
6=1 8539 Tw 3
C 7953 uq4w 1
C 61: 8 uq 6=1 85 Tw

73l knÖk"sq" r o Q" o"xkvykn-
k3] Öb"y [xspy" w Ryknon

$$Mu = \frac{qu \cdot l^2}{8}$$

$$Mu = \frac{18530,44 Nm \cdot 10^2}{8}$$

$$Mu = 231.630,56 Nm$$

l 3] Öb"y" r o Vysx" Rykn

$$Mu = \frac{qu \cdot l}{4}$$

$$Mu = \frac{85.333,33 Nm \cdot 10}{4}$$

$$Mu = 213,333.33 Nm$$

Yy1" r o "y" kvxs" o" xkvp" no- C999; 83=> Tw
999; 81=3=> Tw w

83l knÖk"sq" r o M"no" J sw ox-syx-
Ly" qs"no" nsw ox-syx- "ff Ösq k <5475 nyÖ vo qs"no" 1" r ox
Ll, CLI-I w. -I ". -I s. -I p -I pÖ -I ". -I s
Ll, C7<-53=. -6. -6. -6. -6. -63: . -6.
Ll, C793=9 S zk

$$S_{need} = \frac{Mu}{Fb'}$$

$$S_{need} = \frac{444,963,888.89 Nmm}{24.84 Mpa}$$

$$S_{need} = 17,913.20 mm^3$$

"r o nsw ox-syx-yp" r o qs"no" <5475 -nyÖ vo. k"o Öon1" r ox @
Y C64; Ir⁷
Y C64; 9553=57
Y C87; ; ; 3 < ww⁸
YDYxoon - nsw ox-syx s-yu. 3

93l r onusq Hokw Hoxnsxq
S, CLI, Y
S, C793=9 S zk 7873; ; 3; < ww
S, C=66 995 5553 Tw w =66 99 QT w
S Ö S / 1 /
9993; =66 99 T51=; T51=

9993; : : 63<= -1 oxnsxq" o" s-yu.
: 3l r onusq Hokw Yr ok"
I knÖk"sq] kÖb1] Ö
] Ö C-6=: 85 99 T65470 =: 888 8847.
] Ö C 68: 36=3=> T 68: 37 QT w

I knÖk"sq ükÖb1Lü,
Lü, CLü-I w. -I ". -I s
Lü, C93=-53<-. -6. -6.
Lü, C93<; S zk

I knÖk"sq] kÖb1] ,
] , C748 Lü, / 3
] , C748 916<; Tk55 955
] , C<<3 7 T <=5 QT

Q Zo" w-yp] Ö] / ü/ 1-y@
] Ö] / ü/

68: 37 <=5 /53: /51=

68: 37 9; = -r ok" o" s-yu. 3
I r onusq" r o Hokw J o om'syx
K6 C67 k>> S zk
K7 C<K5; S zk
Ly" r s- "ok-yx1" r o ükÖb y p" kx- py" wk" syx - Ö. s-nknÖk" on
l k-on yx" r o py" w Ök1

$$It = 2 \left\{ \frac{1}{12} b h_1^3 + b h_1 \left(\frac{1}{2} h_1 + \frac{1}{2} h_2 \right)^2 \right\} \frac{E_1}{E_2} + \frac{1}{12} b h_2^3$$

M"no" -sffö
r C5k w C <55 ww r 6 C5 16 w Tk55 ww C<5 ww
l C5 9 w C 955 ww r 7 C<55 <5 <5 C: ; 5 ww

Nox nöl
ÖC6: 166> 9851 593< ww⁹ C 61 66 1983: mw⁹
KRA C<K5; S zk3

ox" r okwy Ö" y pno om'syx s-yl" kx on @
G-k "o-Ö" y p" r o ns- "s l Ö on wykn Ö spy" w l

$$\Delta_l = \frac{5w_L L^4}{384E'I}$$

$$\Delta_l = \frac{5 \times 9,8 \times 10.000^4}{384 \times 15.119.430.504,37 \times 7.706}$$

$$\Delta_l = 10,9273412 mm \approx 1.09 cm$$

J Öb"y" r o zysx" wykn1

$$\Delta_l = \frac{Q_u L^3}{48E'I}$$

$$\Delta_l = \frac{85333,33 \times 10.000^3}{48 \times 15.119.430.504,37 \times 7.706}$$

$$\Delta_l = 15,2585 mm \approx 1.53 cm$$

Zy"kvypj o om'syx CZy"kvno om'syx nÖb"y Ö spy" w ns-
"s l Ö on wykn-0 Zy"kvno om'syx nÖ
"y" r o zysx" wykn

Zy"kvypj o om'syx C7; 3= ww IRAso
J o om'syx ypz o" ws-syx 16" ws-syx C648; 5 C7<3= ww
Zy"kvypj o om'syx B J o om'syx ypVo" ws-syx
7; 3= ww B 7<3= ww -no om'syx "o" s-yu.


4. CONCLUSION

Hk-on yx" r o vld y" k" y" ff kxn" r o -sw Ök" syx "o"-1s" RA-
nyxm Öon" r k" swl o" l okw -RASn RA" o z o" py" w on l ff" RA
ns o" ox" "ffz o- yp" swl o" wk" o" skv- -Ösxq k vksxk" on
nywzy-s" o" onxyvyqff ny Ön lo Ö-on py" l "snqo l okw
wk" o" skv- o- z onskwff py" r o RAynox l "snqo- " Öm Ö o3 o Ö-o
ypk r sqr ' Öks" ff2mk- Ö swl o" wk" o" skv- 75* J sz" o" ynk" z Ö
"swl o". kxn nywzy-s" on RÄr" r o wyRA Öks" ff2mk- Ö =5*
Yr y" ok z ovk" k Yffw" swl o" wk" o" skv ny Ön z" yn Ön r sqr o"
S UK" swl o" -1 RASn s- nywzk" sl w RÄr 69: * "y 6; ; * yp
" r o tÄ" sxq wyRA 2mk- z Öo' Öks" ff yp" r o swl o" wk" o" skv
yx o3 Nox nöl s- "onyww oxnon" r k" y z o" py" w üksnk" syx-
kxn "o"- sx" r o "owükx" ox üs" yxw ox" z" sy" y" r o
swz vov ox" k" syx yp" r s- wk" o" skv" y" r o nsüsv nyx- " Öm'syx
ox qsx oo" sxq k" ok3

AUTHOR INFORMATION

I y“o-zyxnsxq GÖry“

/Kwksv (k“s3kxnr ffküs“sF oxq3Ö“s3kn3n

UXI 

G“sYkxnr ffküs“s @55525557286<92 : 57

ACKNOWLEDGEMENTS

o kÖry“– q“k“opÖff knuxyRAnqo rrs– “o-ok“nr s– Özy“on l ff”ro XskÖXo-ok“nr kxn J oüoyz wox” Gqoxnff -Hks7 kxqnk 1 Vyq“kw Voxqowl kxqkx Zouxxywqs QnÖ“s -VVZO “o-ok“nr q“kx” Ökno“ rro Nsqro“ KnÖk“syx J s“omiy“k“o Mox“okvl S sxs“ffypXo-ok“nr kxn Zonnxywqffl Qnyxo-sk3

REFERENCES

e6g VÖ vma y“u J ozk“wox”16>; 61Vo“k“Ökx Qyx–“Öu-s QkffÖ Qnyxo-sk TÖ 1 VQQÖ6>; 61 J ozk“ow ox Vouo“tklx [wÖw Xoz Ö vsu Qnyxo-sk1fkuk“k3

e7g Tk“syxkv Y“kxnk“nsffk“syx Gqoxnffl 75681 Yzo-s uk-s no-kxs Ö“Öu uyx–“Öu-s ukffÖ-YT O<><8@568. 1HYT 1 HkxnÖq3

e8g QRNQ1756=3 o Yk“o–yp Qnyxo-sk Ly“o–”-756=3 Qow ox“o“skx Rsqxqkx NsnÖ nkx Qor Ökxkx “oz Ö vsu Qnyxo-sk

e9g HVY1 756=1 Yk“s”sm yyp Ly“o–“ff V“ynÖmsyx 756<3 Yk“s”sm l lo“kv HoÖy -Hknkx VÖk” Yk“s”su. 1 Xoz Ö vsu Qnyxo-sk

e: g Nk“ff Mk o“o”-Kns“y“. 1756<1 o pÖÖo ypZswl o“ I yx–“Ömsyx I RZ I “y– Rkwsck”on Zswl o“1 dÖÖk -sx–s”Ö” –o“osnr Mwln1 XÖnyzpk“ffi 674; 16565] soxxk1zz3=27<3

e: g QkRAG3Q3755<3S onr kxsm yypI ywzy–s”o–S k“o“skv-3 I XI V“o–@Hy nk Xk“yx

e<g Hk–1 N33 o“3 kv3 6>>: 1 Zswl o“ Kxqsoo“sxq Y”oz Ö Ls“–Kns“syx l ox“Öw NyÖ1 oT o“r o“vkn-3

e=g H“offo“lJ yxkn3K36>==lJ o-sqx ypzswl o“ Y“ÖmÖo-1 Yonyxn Kns“syx 1S nM“kR2Nswl Qn3T oRÄy“u3

e>g MÖ xuovl M3 6>=61 Zswl o“ Kxqsoo“sxq1 Yonyxn Kns“syx 1 QoxnkW4NÖ” VÖ vs-r sxq I ywz kx ffi J Ö Ö Ö1QRA3

e65g a s”wo“ P“X3 3S kx1 om1HBN31KxyRÄku1B3P36>>>1 Vk“skv I ywzy–s”o Gmsyx sx Nk“n”swl o“ MÖn2Rkw sk”on Z2Hokw-1 ByÖxkv yp H“snqo Kxqsoo“sxq1] yvÖwo 91Ö-Ö 61zz 378Z7>3

e66g Nk“ywy G3P3 XÖ-nr k“yxy G3 nkx Nk“ntlx”y J 3 6>>71S owkr kw s Vyvsw o“ nkx Vo“ouk”1z ox o“l s” Gxns y –o”1c yqffkuk“k3

e67g Qyükynt Ö1R3 3 nkx Hkv“Ör ks”s-1G3 3 6>=>1K om” ypzswl o“ nopom”yx o Y“oxq”r ypMÖ Y“ÖmÖo1 Ömio–sffk2] ff–r sur 2] nr ol xffur 2d Öxkvl Ty3 81 zz3 <; 2=53

e68g V“kffs”xy1 Z3 G3 6>>91 o K om” yp a rs”o I vkff KThö”syx 1 Vk“smo Ysfio kxn MÖ Yz“okn yx [“ok Ly“wknor snoZswl o“ Hyxn Y“oxq”r 1 HÖwo”sx LkuÖk–Qor Ökxkx 1Ty37: 1zz 3762973

e69g Mo“ol P3 3 Zswy-r oxuy 1 Y33 6>=<1 S onr kxsm yyp S k“o“skv-1 Ls“–” Kns“syx 1 a kn-RÄ”r 1 Qn3 Howwyx” 1 I kspy“x sk3

e6: g Yywkkffktsl Y3 6>>: 1 I süsv Kxqsoo“sxq S k“o“skv-1 V“ox”smo Nkw1Kxqvo”swl o“ll vs –1T oRÄb–off3

e6: g S Örwksxkr 3 Yknsffy 1 Y3 Qk“vsk-k“s1 R3 75691 QouÖk”kx Zoukx Zoqku RÖÖ- Yo“k” I “y– Rkwsck”on Zswl o“ -I RZ. Zsqk Pxs– QkffÖ Xkuffk” 1 P3 Öw Ö Zouxys3 QkffÖ Z“yzs–] yv3 67 Ty3 PÖs 75691 z kqo 689269:

e6<g L“kxqsk1 G3 Lyx”kxk1 S 3 NÖqsl 1 K3 P 1 –vi X3 755>1 KThö”sw ox”kvkxkff–s–ypmty–2kwsck”on ”swl o“ z kx ov-sx “o1 Ls“o Ykpp”ff ByÖxkvl] yvÖwo 991 Ö-Ö =1 Tyüowl o“ 755>1V kqo–65<=265=<

e6=g a so-x o“1L3Hs-1 fflR3 756>1 o –“ÖmÖkvnkz kns”ffyp vkw sk”on ”swl o“ nywz “o–syx owow ox”–sx “o@Gw o”k 2kxkff-s-1Ls“o Ykpp”ff ByÖxkvl] yvÖwo 65<1PÖff 756>1 V kqo–669267:

e6>g GYZS J 6982>91 Y“kxnk“n Zo–” S o”r yn– py“ Ywkw I vok” Yz onsw ox– ypzswl o“1 GYZS Q”o“xk”syxkvl a o–”I yx-r yrynuox 1VG17555



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