

-RXUQDO RI (QJLQHHULQJ 6FLHQFH)

9ROXPH ,VXXH SS

<http://doi.org/10.56958/jesi.2019.4.4.411>

7HFKQLFDO 6FLHQFHV
\$FDGHP\ RI 5RPDQLD ' &LYLO (QJLQHHULQJ DQG 7UDQVSRUW
ZZZ MHVL DVWU UR

5HFHLYHXQH \$FFHSWHG 'HFHPEHU
5HFHLYHG LQ UHMSWHG IURP

'HWHFWLRQ RI YHUWLFDO GHIRUPDWLRQ LQ
VSHHG WUDLQ URXWH XVLQJ ; 6\$5 DQG 6

\$75, <21 -8/= \$5, . \$ & \$785 \$5, (6 58. +0\$1\$

*HRGHV\ *HRPDWLFV (QJLQHHULQJ 8QLYHUVLWDV *DGMDK OD
,QGRQHVLDO 1DWLRQDO ,QVWLWXWH RI \$HURQDXWLFV DQG

\$EVWUXFW-DNDUWD %DQG XQJ KLJK VSHHG WUDLQ LV RQH RI WK
KLJK VSHHG WUDLQ URXWH FRQQHFV WKH -DNDUWD FLW\ WR
GHWDLOHG WRSRJUDSK\ DQG FKHFNLQJ RI YHUWLFDO GHIRUPD
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RI WKHVH WRSRJUDSK\ PXVW PHHW WKH WROHUDQFH RI VLJ
LV DOVR PRUH RSWLPDO 7KH UHVXOWV RI WKLV VWXG\ FDQ EH
KLJK VSHHG WUDLQ URXWH EDVHG RQ FRQGLWLRQV RI YHUWLFDO

.H\ZRUGV YHUWLFDO GHIRUPDWLRQ 'LQ6\$5 +LJK VSHHG WUDLQ ;

,QWURGXFWRQ

7KH ILUVW KLJK VSHHG WUDLQ SURMHFW LQ ,QGRQHVLDO
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LQ -XO\ 7KH SURMHFW LV DOVR H[SHFWHG WR GHYHO
RI -DNDUWD ZLWK WKH FLW\ RI 6XUDED\D -DSDQ DQG WKH
H[SUHVVHG WKHLU LQWHUHVW LQ SDUWLFLSDWLQJ LQ W
\$VLDO FRXQWULHV KDG KHOG D FRPSUHKHQVLYH VWXG\
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> @ DQG VHYHUDO GHYHORSLQJ FRXQWULHV 7KH -DNDUW
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&RUUHVSRRGHQFH DGGUHVV HUEKDNRY#\DKRR FRP

-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G

FRQGLWLRQV ZLWK FHUWDLQ FKDUDFWHULVWLFV 7KLV
SK\VLRJUDSK\ DQG UHJLRQDO VWUDWLJUDSK\ RI :HVW -DY
SK\VLRJUDSK\ KDV]RQH V ZLWK JHRORJLFDO FKDUDFW
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> @ > @ ,QGRQHVLD LV SURQH WR JHRORJLFDO GLVDV
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JHQHUDOO\ FDXVHG E\ JHRG\QDPLFV LQ WKH IRUP RI
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QHHGHG IRU GLVDVWHU PLWLJDWLRQ > @ 2QH ZD\ WR JH
VHQVLQJ GDWD

,Q SULQFLSOH HYHU\ REMHW DQG QDWXUDO SKHQRPHQW
GHWHFWHG IURP VDWHOOLWH LPDJHU\ 7KH DELOLW\ RI
DQG QDWXUDO SKHQRPHQW WKDW RFFXU GHSHQGV RQ WK
UDGLRPHWULF DQG WHPSRUDO *HRORJLFDO GLVDVWHUV
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H[RJHQRXV RU EHQHDKW WKH VXUIDFH RI WKH HDUWK
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GLVDVWHU 7KLV VWXG\ DLPV WR PDS YHUWLFDO GHIRUP
RI WKH -DNDUWD %DQG XQJ KLJK VSHHG WUDLQ URXWH SO

/RFDWLRQ RI WKH 6WXG\ \$UHD

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-DNDUWD]RQH LV RQ WKH QRUWK FRDVW RI -DYD ZLWK D
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)LJ 3K\VL RJUDSK\ RI :HVW -DYD > @

%DVHG RQ WKH UHJLRQDO VWUDWLJUDSK\ RI :HVW -DYD VWUDWLJUDSK\ ZKLFK LV D PHODQJH FRPSOH[QDPHO\ RFHDQLF FUXVWDO URFNV DQG FRQWLQHQWDO FUXVWDO PHWDPRUSKLF YROFDQLF DQG LJQHRXV URFNV ZKLFK DU LQ WKH QRUWKHUQ SDUW RI WKH :HVW -DYD VHD > @ PHODQJH FRPSOH[ZDV IRUPHG LQ WKH VRXWKZHVW RI :H ZDV WKRXJKW WR EH SDUW RI WKH VXEGXFWLRQ]RQH LQ QRUWKHUQ UHJLRQ RI :HVW -DYD LV NQRZQ DV WKH -DWL SURGXFW GHSRVLWLRQ UHVXOWLQJ IURP YROFDQLF HUXS ZDV RQ FRQWLQHQWDO FRQGLWLRQV 7KLV LV LQGLFDWHG LWV IRUPDWLRQ 5DMDPDQGDOD 6XNDEXPL LV WKH WHUW *XQXQJ :DODW IRUPDWLRQ WKDW ILOOV WKH LQWHUDUF E

ODWHULDOV DQG OHWKRGV

'HIRUPDWLRQV

'HIRUPDWLRQ LV D FKDQJH LQ WKH VKDSH SRVLWLRQ D 'HIRUPDWLRQ FDQ EH LQWHUSUHWHG DV D FKDQJH LQ WK LQ DQ REMHFV LQ DEVROXWH RU UHODWLYH WHUPV \$E EHKDYLRU RI WKH PRYHPHQW LV DW WKH SRLQW LWVHOI PRYHPHQW LV DVVHVVHG IURP DQRWKHU SRLQW > @ &K

-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G

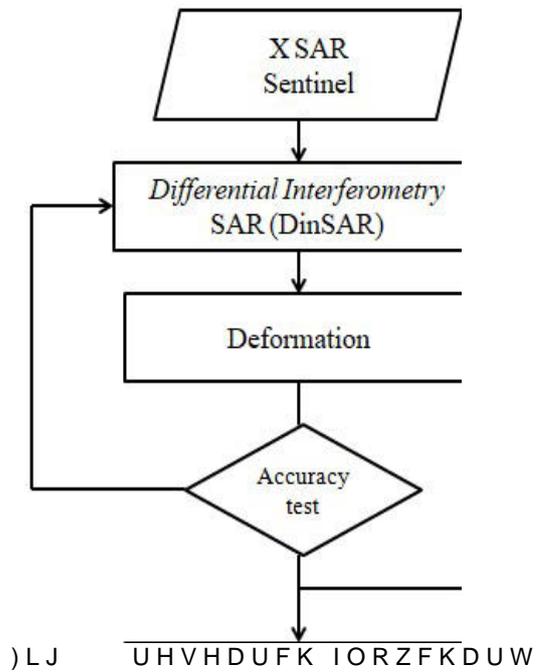
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VXUYH\V > @ 'HIRUPDWLRQ DQG JHRG\QDPLFV VXUYH\V
VXUYH\V FRQGXFHWG WR VWXG\ WKH SKHQRPHQRQ RI GHI
SKHQRPHQRQ LV D QDWXUDO SKHQRPHQRQ DQG RWKH
SKHQRPHQD VXFK DV SODWH WHFWRQLF PRYHPHQWV YRC
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DQG VR RQ 'HIRUPDWLRQ DQDO\VLV FDQ EH GRQH JHRP
DQDO\VLV LV D VKLIW DQG VWUDLQ

,QWHUIHURPHWULF 6\QWKHWLF \$SHUWXUH 5DGDU

,QWHUIHURPHWULF 6\QWKHWLF \$SHUWXUH 5DGDU ,Q6\$5
WKDW XVHV UDGDU LPDJHV VHQVRU IURP DLU VDWHOOLV
XVHG WR H[WUDFW WkuHH GLPHQVLRQDO ' LQIRUPDWLF
REVHUYLQJ WKH UDGDU ZDYH SKDVH > @ > @ 5DGDU V
HPLW UDGDU ZDYHV FRQVWDQWO\ WKHQ WKH UDGDU ZDY
EDFN E\ WKH VHQVRU GXH WR EHLQJ UHIOHFWHG E\ WDUJ
,QLWLDOO\ UDGDU LQWHUIHURPHWU\ ZDV XVHG IRU REVH
SODQHW 9HQXV ,Q WKLV WHFKQLTXH ZDV ILUVW DSS
REWDLQ WKH WRSRJUDSK\ RI WKH LPDJH PXVW EH IXOI
REMHFWV RQ WKH VXUIDFH RI WKH HDUWK WKDW DUH LP
KLJK LPDJH UHVROXWLRQ VR WKDW LQWHUSUHWDWLRQ D
DFFRUGLQJO\ > @ 5DGDU LPDJHV REWDLQHG IURP DLU
LPSRUWDQW LQIRUPDWLRQ 7KLV LQIRUPDWLRQ LV WKH H
DQG DPSOLWXGH ZKLFK LV LQIOXHQFHG E\ WKH QXPEHU
EDFN > @
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DQDO\VLV FDQ EH XVHG IRU WKH H[WUDFWLRQ RI KHLJK
6XUIDFH ORGHO '60 DQG KLJK FKDQJHV LQ YHUWLFDO GH
,Q6\$5 XVHV GLIIHUHQFHV LQ SKDVH PHDVXUHPHQWV WR
GLVWDQFH FKDQJHV IURP WZR RU PRUH 6\$5 LPDJHV WKDW
VDPH VXUIDFH > @ 7KH UHVXOW RI WKH GLIIHUHQFH IUR
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KDYH D FRORU FLUFOH SDWWHUQ IULQJHV LQ WKH VXUID

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7KLV VWXG\ IROORZV WKH UHVHDUFK IORZFKDUW DWWD
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RI WKLV UHVHDUFK LV LQ -DNDUWD %DQG XQJ KLJK VSHHG
DUH ; 6\$5 LQ 6HQWLQHO LQ DQG -DNDUWD %DQG
YHFRU ; 6\$5 DQG 6HQWLQHO DUH PDGH WRSRJUDSKLFD
GHIRUPDWLRQ ZDV FDUULHG RXW XVLQJ WKH 'LIIHUHQ
\$SHUWXUH 5DGDU 'LQ6\$5 PHWKRGR > @ > @ ,Q VLPS
UHGXFWRQ RI WZR WRSRJUDSKLHV DW D PLQLXP RI W
RI GDWD IRU GHIRUPDWLRQ FDOFXODWRQV \RX FDQ XVH
,QWHUIHURPHWU\ 36 ,Q6\$5 > @
,Q PHWKRGR 7KLV GHIRUPDWLRQ QHHGV WR EH WHVWHG
WRSRJUDSK\ KDV PHW WKH WROHUDQFH RI 1 ZLWK
GHIRUPDWLRQ DOVR PHHWV WROHUDQFH 7KHQ WKH WUD
WKH GHIRUPDWLRQ 7KLV DLPV WR GHWHUPLQH WKH GH
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KLJK VSHHG WUDLQ VDWLRQV 7KH ILQDO UHVXOWV RE
LQIRUPDWLRQ DERXW GHIRUPDWLRQV WKDW RFFXUUHG L
KLJK VSHHG WUDLQ URXWH DQG KLJK VSHHG WUDLQ V
FDUULHG RXW E\ FKHFNLQJ YHUWLFDO GHIRUPDWLRQ ZDV



-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G

; 6\$5

7KH PLVVLRQ RI 7RSRJUDSK\ 6KXWWOH 5DGDU 6570 '7
)HEUXDU\ LV D 86 *HUPDQ ,WDOLDQ HIIRUW WR SURG
(OHYDWLRQ 0RGHO '(0 > @ 7KH *HUPDQ \$HURVSDFH
,WDOLDQ 6SDFH \$JHQF\ \$6, FRPSOHWH 1\$6\$ -3/ & EDQG
'6\$5 ORDGV ZLWK DGGLWLRQDO ; 6\$5 LQVWUXPHQWV 657
RQ WKH '/5 IURP WKLV LQVWUXPHQW GDWD XVLQJ UDGDU
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H[WHQVLRQ SROH
ORVW RI WKH JOREDO ODQG VXUIDFH EHWZHHQ f 1RUWK
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ZLWK D QDUURZHU DSHUWXUH DQJOH LPDJHV WKH GDWD
JURXQG WUDFH DSSUR[LPDWHO\ 7KHUHIRUH WKH DYDI
FRYHUDJH 7KH RULJLQDO 6570 '7(' 65(' ; 6\$5 '(0 KDV EH
WLOH f [f FRQYHUWHG WR *HR7,)) IRUPDW DQG SDF
(DFK]LS ILOH FRQWDLQV D '(0 GDWDVHW VXLWDEOH
TXLFNORRN LQ SQJ LPDJH GLVSOD\ NPO RYHUOD\ DQ
ILOH DUFKLYH QDPH VSHFLILHV WKH ORZHU OHIW FRRUGI
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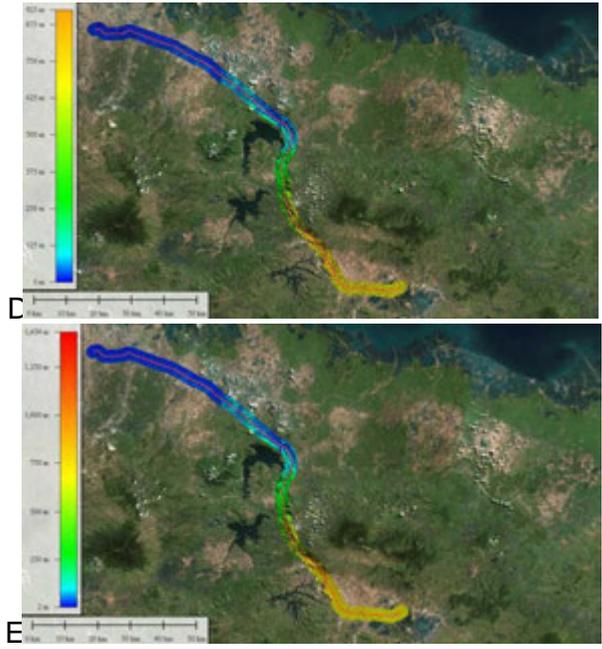
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7KHVH PLVVLRQV FDUU\ D YDULHW\ RI WHFKQRORJLHV V
LPDJLQJ LQVWUXPHQWV IRU WHUHVWULDO PDULQH D
PLVVLRQ RI WKH &RSHUQLFXV SURJUDP LQFOXGHV V
6HQWLQHO 6HQWLQHO 6HQWLQHO 3UHFXUVRU 6HQW
> @

5HVXOWV DQG 'LVFXVVLRQ

9HUWLFDO GHIRUPDWLRQ

9HUWLFDO GHIRUPDWLRQ LV GHWHFWHG XVLQJ ; 6\$ D
GHIRUPDWLRQ PRQLWRUH LV 7KH ; 6\$ GDWD XV
7KH 6HQWLQHO GDWD XVHG LV 7KH PHWKRGV XVHG
GHIRUPDWLRQ DUH LQWHUIHURPHWU\ DQG 'LQ6\$5 ,QWHU
'60 ; 6\$ GDWD LV GHILQH DV PDVWHU GDWD DQG K

GHIRUPDWLRQ a PP 6HQWLQHO GDWD LV GHILQH D
PDGH '60)LJXUH D ZKLOH 6HQWLQHO ZDV DOVR PDGH
6\$5 XVHV EDQG ; ZKLOH 6HQWLQHO XVHV EDQG & 7KH GI
EH GRQH LQ WKH UHIHUHQFH ILHOG HTXDWLRQ 7KLV '60
WR FRUUHFW WKH KHLJKW HUURUV DQG FRUUHFW WKH JH



)LJ D '60 ; 6\$5 RI E '60 6HQWLQHO RI

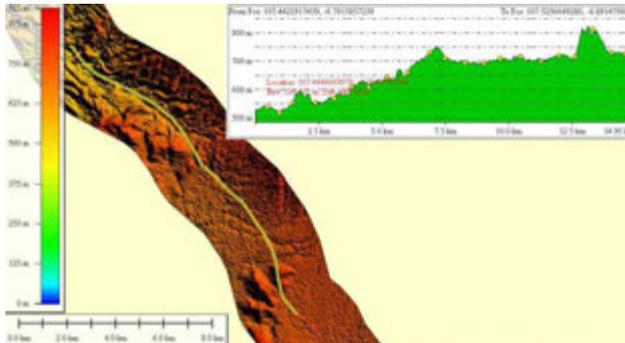
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+HLJKW HUURU FRUUHFWLRQ XVLQJ D [PDWUL[ILOWHU
'60 ZKLFK DUH KHLJKW HUURU IUHH DQG KDYL WKH V
WKHQ '60 '(0 FRUUHFWLRQ LV GRQH 7KLV FRUUHFWLRQ D
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PLQLPLJH YHJHWDWLRQ DQG EXLOGLQJV VR WKDW LW OH
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PDSSLQJ WROHUDQFH WKDW KDV EHHQ GHWHUPLQH ZLV
DQG '(0 RQO\ IRFXVHG RQ YHUWLFDO DFFXUDF\ ZLWK
HVVDEOLVKHG WROHUDQFH > @ WKHQ 'LQ6\$5 ZLOO GR LV
UHVHDFK LV WR UHGXFH '(0 ZLWK '(0 7KH UHVX
YHUWLFDO GHIRUPDWLRQ)LJXUH LV WKH UHVXOW RI YH
WR '(0

-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G



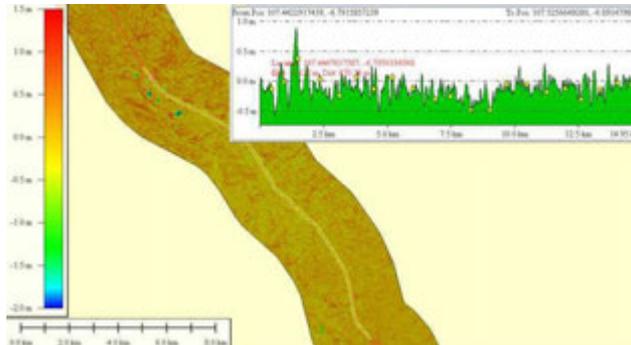
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H[WHQGLQJ DORQJ WKH SODQ RI D KLJK VSHHG WUDLQ
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H[DPSOH RI D SURILOH H[WHQGLQJ WKH SODQ RI D KLJK
WKURXJK KLOOV DQG ULYHUV)LJXUH LV WKH LQLWLDO
GLUHFWRQ RI -DNDUWD WR %DQGXQJ 7KLV ORFDWLRQ
HDVW ORQJLWXGH VRXWK ODWLWXGH
HDVW ORQJLWXGH VRXWK ODWLWXGH)LJ
RI WKH SURILOH H[WHQGLQJ WKH GLUHFWRQ RI -DNDUWD



)LJ 7KH SURILOH H[WHQGV RQ WKH SODQHG KLJK VSHHG WUDLQ
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,Q DGGLWLRQ DW WKH ORFDWLRQ RI WKH VDPSOH DW W
[PDUN RQ WKH KLJK VSHHG WUDFN SODQ LW FDQ DOVR
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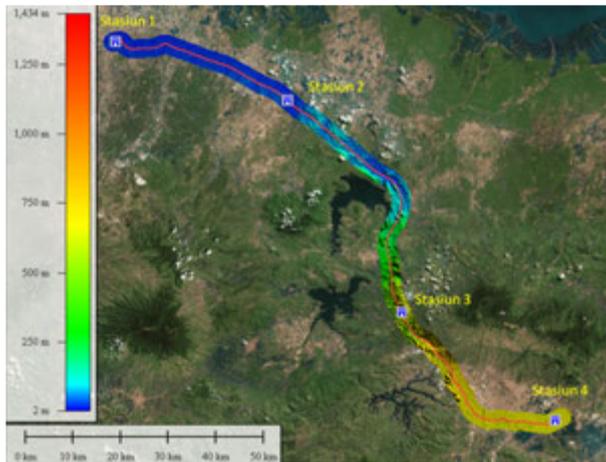


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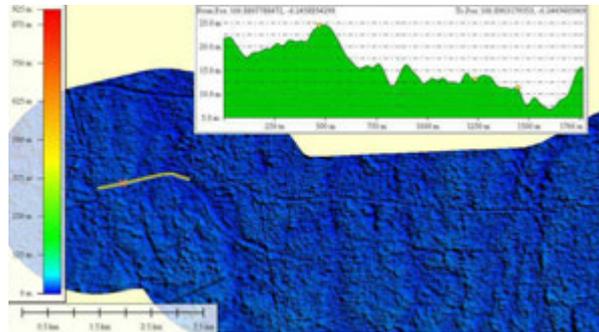
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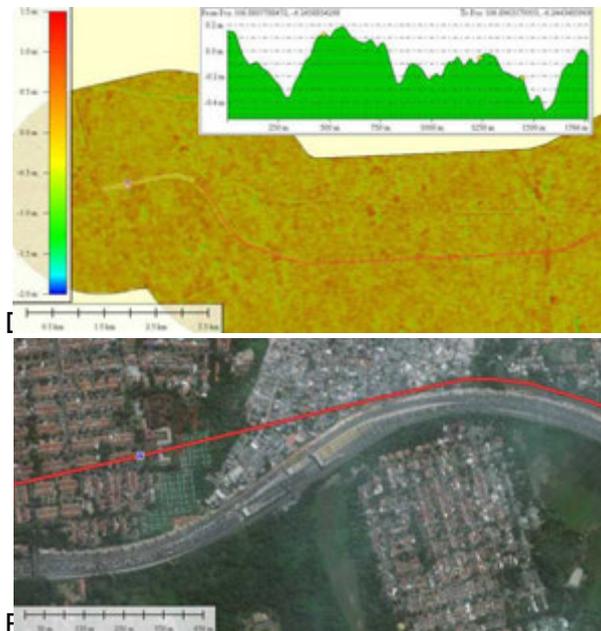
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-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G
 ZD\ WR GR WKLV LV WR RYHUOD\ VWDWLRQ SRLQW WR



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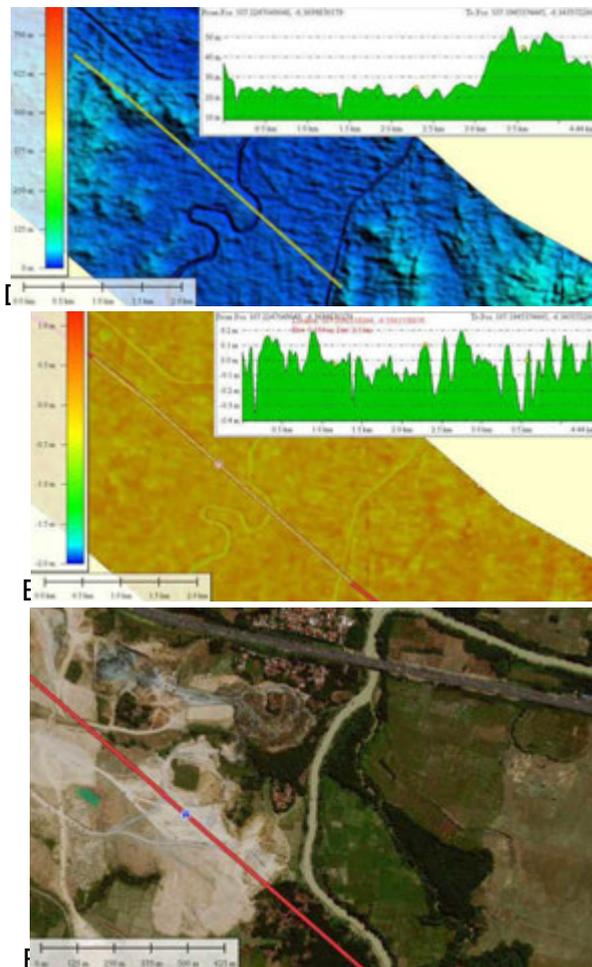
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 FDXVHG WKH FRUHFWRQ RI '60 WR EHRPH D '(0 WR EH
 SUHFLVHO\ LW LV QRW ZRUU\LQJ DERXW WKH YHUWLFDO
 KLJK UHIHUHQFH ILHOG '(0 DQG '(0 DUH WKH V
 UHTXLUHPHQW LQ WKH KLJK GLIIHUHQFH WHVW



)LJ D 9HUWLFDO GHIRUPDWLRQ DW WKH SODQQHG VWDWLRQ -
 E 6LJQ [ORFDWLRQ RI WKH SODQQHG -DNDUWD %DQG XQJ KLJK VSHH

-RXUQDO RI (QJLQHULQJ 6FLHQFHV DQG ,QQRYDWLRQ 9R

6WDWLRQ KDV YHUWLFDO GHIRUPDWLRQ RI a P
 GHIRUPDWLRQ YDOXH RFFXUUHG IURP WR 9HUWLF
 ZDV VWLOO LQ D VPDOO VFDOH VWDJH DQG QRW D VLJQL
 6WDWLRQ LV ORFDWHG LQ %HNDVL 5HJHQF\ ,Q WKLV DU
 P HOHYDWLRQ 7KLV ORFDWLRQ LV ORFDWHG DGMDFHQ
 WKDW RFFXU LQ WKLV UHJLRQ DUH a P WR P IUR
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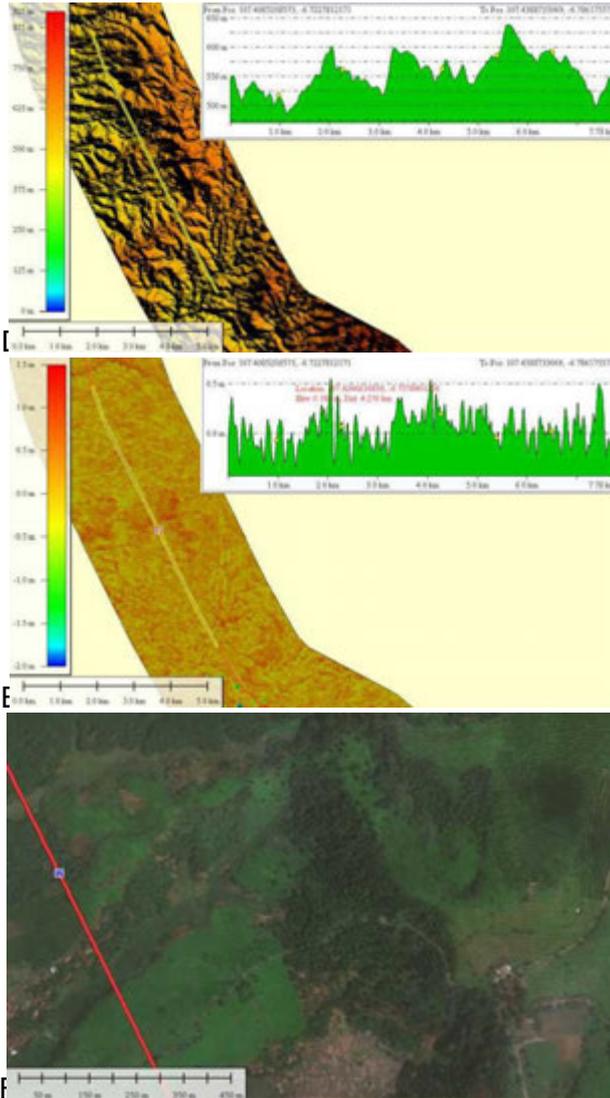


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 7KH [VLJQ LV WKH ORFDWLRQ RI WKH SODQQHG VWDWLRQ -DNDUWD
 LPDJHU\ F

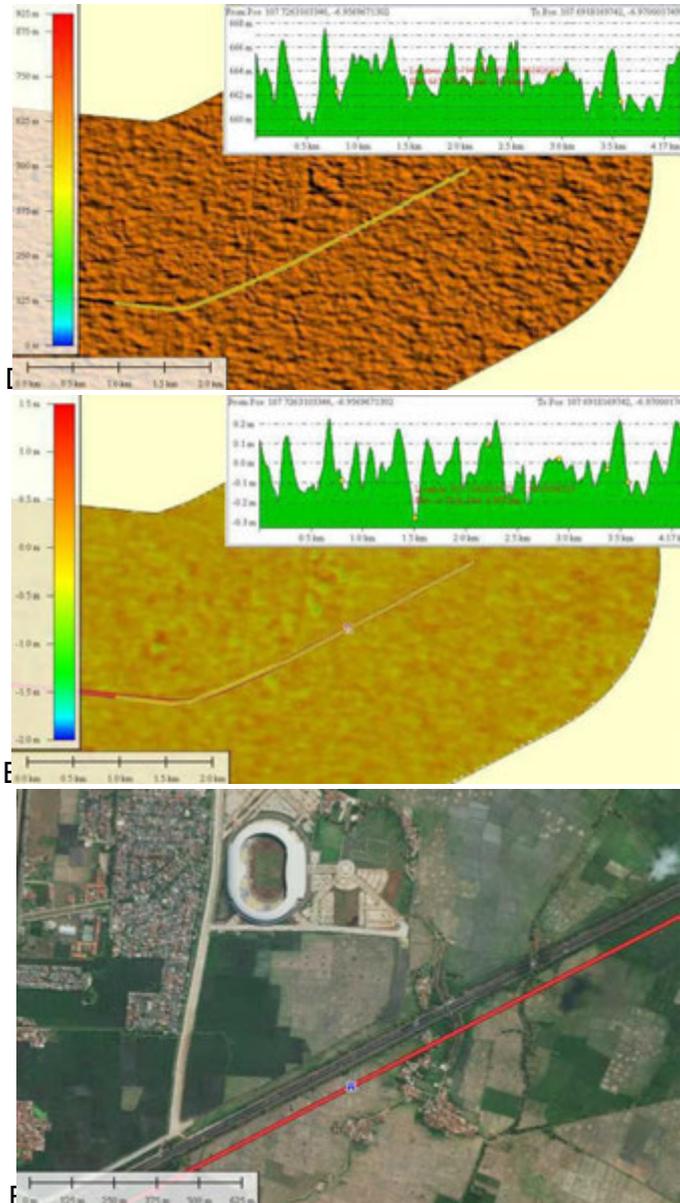
6WDWLRQ LV ORFDWHG LQ :HVW %DQG XQJ 5HJHQF\ ,Q W
 WR EH KLOO\ 7KLV KLOO\ SDWWHUQ FDQ EH VHHQ IURP W

-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G

WKDW SDVVHV VWDWLRQ 6WDWLRQ LV ORFDWHG DW
GHIRUPDWLRQV WKDW RFFXU DW VWDWLRQ DQG DURXQG
WR 9HUWLFDO GHIRUPDWLRQ LV UHODWLYHO\ VPDOO
WKH JHRORJLFDO FRQGLWLRQV RI WKH DUHD DQG UDUHO\
'(0 DQG YHUWLFDO GHIRUPDWLRQ DW VWDWLRQ FDQ E



)LJ '(0 D DQG YHUWLFDO GHIRUPDWLRQV IURP E DW
7KH [VLJQ LV WKH ORFDWLRQ RI WKH SODQQHG VWDWLRQ RI WKH
:RUOG9LHZ LPDJHU\ F



)LJ '(0 XS DQG YHUWLFDO GHIRUPDWLRQV IURP ERWW
SODQV 7KH [VLJQ LV WKH ORFDWLRQ RI WKH SODQQHG VWDWLRQ R
:RUOG9LHZ LPDJHU\

&RQFOXGLQJ UHPDUNV

7KH -DNDUWD %DQGXQJ KLJK VSHHG WUDLQ OLQH QHHGV
YHUWLFDO GHIRUPDWLRQ 9HUWLFDO GHIRUPDWLRQ PDG
6HQWLQHUV LQ 7KH PHWKRG XVHG IRU PDNLQJ WK

-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G

'LQ6\$5 9HUWLFDO GHIRUPDWLRQ YDOXHV DORQJ WKLW K
UDQJH RI WR P 7KH YDOXH DOVR LQFOXGHV K
VWDWLRQ DUHD YHUWLFDO GHIRUPDWLRQ RI a P W
DURXQG VWDWLRQ XQGHUJRHV YHUWLFDO GHIRUPDWLRQ
VWDWLRQ XQGHUJRHV YHUWLFDO GHIRUPDWLRQ RI a
VWDWLRQ ZKLFK H[SHULHQFHV YHUWLFDO GHIRUPDWLRQ
YHUWLFDO GHIRUPDWLRQ RFFXUV LQ WKH VWDWLRQ DUH
WKDW RFFXU DORQJ WKH WUDLQ OLQH DUH UDSLGO\ GH

\$FNQRZOHGJHPHQWV
7KDQN \RX WR OU 5LJNL IRU WKH -DNDUWD %DQG XQJ KLJ
7KDQNV DOVR WR 8QLYHUVLWDV *DGMDK ODGD DQG /\$3\$1
7KDQNV WR '15 DQG (6\$ IRU WKH GDWD XVHG %RWK DXWK
WKLW SDSHU

\$XWKRU V 1RWH
7KH DXWKRUV GHFODUH WKDW WKHUH LV QR FRQIOLFW R
WKLW DUWLFOH \$XWKRUV FRQILUPHG WKDW WKH GDWD D

5HIHUXQFHV
> @6356\$6356 \$FFXUDF\ 6WDQGDUG IRU 'PHW DODQH RRS DWW DORUWD
3KRWRJUDPPHWU\ DQG 5HPRWH 6HQVLQJ \$6356 8QLWHG 6WDWHV RI
> @ %DWHV 5 / *DFWWRQ RIR (GRWLRQ \$PHULFDQ *HRORJLFDQ ,C
\$OH[DQGLD S
> @ %HUDUGLQR 3)RUQDUR \$ Q/DZ DOLJULW 6DQVWRU WKU\DFH GHIRU
PRQLWRULQJ EDVHG RQ VPDOO EDVHO, LQH7GDQMUH RMLDLO 6\$PRW WHU
6HQV S KWWS UHIKX HOVHYLHU FRP 6 K
> @ &KDQJ / 'ROOYRHW DL OZDADLOMVHQV UXFWXUH PRQLWRULQJ XVLQ
GDW, DW - 5DLOZD\ 7HFKRO YRO S ±
> @ &KDQJ / 'ROOYRHW 5 13DWLRQZLGDQV DHOZD 0RQLWRULQJ 8VLQJ
6\$5 ,QWHUHQRP SWUVRQDO XVH LV SHUPLWWHG EXW UHSXEOLFDWLR
SHUPLVVLRQ
6HH KWWS ZZZ LHHH RUJ SXEOLFDWLRQV VWDQGDUGV SXEOLFDWLRQ

> @ &KDQJ / +DSSURDFK DLVWLF DSSURDFK IRU ,Q6\$5 WLPVHULHV
7UDQV *HRVFL 5HPRWH 6HQV ±
> @ &KUJDQRZWHFKQLFDQ DQG RWKHU QRQ JHRGHWLF PHWKRQ LQ
3URFHGHGLQJV RI WKH 'HIRUPDWLRQ OHDVXUHPHQW :RUNVKRS 2FW
ODVDFKXVHWV ,QVWLWXWH RI 7HFKRORJ\ &DPEULGJH 0\$
> @ &URVHWR 0 &ULSSD % %LHVFDV (0RQVGHU RUPDWLRQ GR 0
PRQLWRULQJ XVLQJ 6\$5 LQWHUHQRP SWUVRQDO XVH LV SHUPLWWHG EXW UHSXEOLFDWLRQ
S ±
> @ &URVHWR 0 0RQVHUUDV SDFK RRUQ GLIHHULSSDD 6\$5 LQWHU
GDWD DQDO\VLV WRROV IRU 5HPRWH RUPDWLRQ PHDVXUHPHQW
> @ &XHQFD 0 & +RRSHU6\$U\DFH DGHUHQDWRQ LQGXFHG E\ ZDWHU
DEDQGRQH FRDO PLQHV LQ /LPEXUJ WKH 1HWKHUODQGV REVHUYH
- \$SSO *HRSKIV S
> @ '1570 ; *HUPDQ \$HVSDFH &HQWHU '15 VWDFFHVHG LQ 0DU
KWWSV ZZZ GOU GH HRF HQ GHVNWRS GHIDXOW DVS[WDELG BU

-XOJDULND \$ 5XNKPDQD & \$ 'HWHFWLRQ RI YHUWLFDO G

> @ 5|GHOVSHUJHU 6 %HFNHU 0 *HUVWHQHFNHUUJ&WD0XIHU * 6FK
HOHYDWLRQ PRGHO ZLWK WKH JURXQG EDVHG 6\$5 ,%,6 / DV EDVLV IR
*HRG\Q S ±
> @ 8ODE\) 7 0RRUH 50LFURZDYH\$5HPRWH 6HQVLQJ \$FWLYH DQG 3
9ROXPH 6FDWWHULQJ DQG (PLVVLRQ 7KHRUS\$USGFRQFRXGV\QHPV DQ
'HGKDP 0DVVDFKXVHWWV YRO ,,,
> @ YDQ %HPP7HCHORJ\ RI ,QGRQHWHLDQPHROW 3\$ILQLQJ 2IILFH 7
+DXJH
> @ YDQ /H3MHQYWHQW 6FDWWHUHU ,QWHUIHURPHW\W% DVHG RQ *HR
1HWKHUODQGV *HRGHWF &RPPLVVLRQ
> @ :LNL\$HGLVSHHG UDLO :LNL\$GGRDHWLDFHVWHG LQ 2FWREHU
KWWSV HQ ZLNLSHGLD RUJ ZLNL +LJK VSHHG BUDLOBLQB,QGRQHVL D