[illegible]

COMPARISON OF SLOPE STABILITY PROGRAM

[illegible][1], [illegible][2]

[1] [illegible]
[illegible]
[1] [illegible]
[illegible]

[illegible]: [illegible] (User Interface), [illegible] Morgenstern and Price), [illegible] Slope/W, Sb-slope, Xstabl, KUslope [illegible]

ABSTRACT: Presently, slope stability analysis had played an important role in civil engineering construction such as dam, highway, canal and retaining wall. In general, The personal computer can be effectively used for the analysis comparing to manual calculation. This paper presents the comparison of several stability analysis programs available. The user-friendly interface, computation accuracy (as comparing to Morgenstern and Price method), speed, presentation, price and other features are considered for comparison. Several local well-know programs such as Slope/W, Sb-slope, Xstabl, KUslope are investigated. The main purposes of the study are aiming to be the reference for engineer to make appropriate selection, and also for support the developing expert system for slope stability analysis.

KEYWORDS: Slope Stability, Computer Program, Comparison

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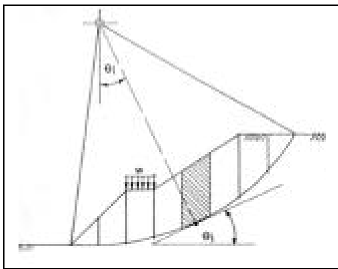
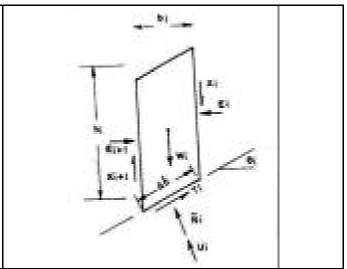
1.º·¹íÒ

¡ÒÃÇÔ¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾ã¹»˜¨¨ØºÑ¹ ä´éÁÕâ»Ãá¡ÃÁ¤ÍÁ¾ÔÇàµÍÃìªèÇÂÇÔà¤ÃÒÐËìÍÂèÒ§¡ÇéÒ§¢ÇÒ§ «Öè§ÁÕ¡ÒÃ¾Ñ²¹Ò»ÃÐ»Ø¡µìãªé§Ò¹ËÅÒÂâ»Ãá¡ÃÁ·Ñé§ã¹µèÒ§»ÃÐà·ÈáÅÐã¹»ÃÐà·Èä·Â â´ÂáµèÅÐâ»Ãá¡ÃÁµèÒ§¡ç¨ÐÁÕ¢éÍ´Õ¢éÍ¨ÓËÑ´·Õè¢Ö¹Í¡ºàªµá Å¤ÇÒÁÊÒÁÒÃ¶·Õèµ¡µèÒ§¡Ñº »¤ÇÒÁ¹èÒàª×èÍ¶×Í¢Í§¼ÅÅÑ¾¸ì·Õèä´é¨Ò¡ÀÒÃÇÔà¤ÃÒÐËì ÊÓËÃÑº¡ÒÃÈÖ¡ÉÒ¹Õé ä´éà»ÃÕÂºà·ÕÂºâ»Ãá¡ÃÁÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹ËÅÒÂâ»Ãá¡ÃÁ ä´éá¡è ¢éÍÁÙÅÃÒ¤Ò ¤ÇÒÁÊÐ´Ç¡ã¹¡ÒÃãªé§Ò¹ ¤ÇÒÁ¶Ù¡µéÍ§ áÅÐ¢éÍ¨ÓËÑ´¢Í§áµèÅÐâ»Ãá¡ÃÁ ÃÇÁ·Ñé§¢éÍá¹Ð¹Ó¡ÒÃàÅ×Í¡ãªéâ»Ãá¡ÃÁÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹·ÕèàËÁÒÐÊÁ¡Ñº§Ò¹áµèÅÐ»ÃÐàÀ·

2.·ÄÉ®Õ·Õèà¡ÕèÂÇ¢éÍ§

ËÅÑ¡¡ÒÃ·ÑèÇä»¢Í§¡ÒÃÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹ ·Õè¹ÔÂÁ ã¹»˜¨¨ØºÑ¹¤×ÍÇÔ¸Õ "ÊÁ´ØÅ¢Õ´ÊØ´" ËÃ×Í "ÊÁ´ØÅ ¢Õ´¨ÓÑ´" (Limit Equilibrium) ÇÔ¸Õ¹ÕéÁÕËÅÑ¡¡ÒÃ "¾Ô¨ÒÃ³Ò ÁÇÅ´Ô¹à»š¹ ªÔé¹à´ÕÂÇ ËÃ×ÍËÅÒÂªÔé¹ ¹Ó¼ÅÃÇÁ¢Í§áÃ§ ÁÒ¤Ó¹Ç³ËÒÊÁ´ØÅ" ¡ÒÃÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹â´ÂÇÔ¸ÕÊÁ´ØÅ¢Õ´ÊØ´ ¨ÐµéÍ§ÁÕ¡ÒÃ ÊÁÁµÔ °Ò¹ ¡ÒÃ ¾Ñ§·ÅÒÂ µÒÁ ÃÙ»ÃèÒ§ ¢Í§ ¼ÔÇ ¡ÒÃ ¾Ñ§·ÅÒÂ ·Õè¤Ò´ÇèÒ ¨Ð à¡Ô´¢Öé¹ áÅÐ¾Ô¨ÒÃ³ÒÊÁ´ØÅ¢Í§ÁÇÅ´Ô¹ ·Õè ¾Ñ§·ÅÒÂ ËÒ¤èÒÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂ (Factor of Safety, F.S.) áÅÐ¼ÔÇ¡ÒÃ¾Ñ§·ÅÒÂ·ÕèÇÔ¡ÄµÔ·ÕèÊØ´ ¤×Í¼ÔÇ¡ÒÃ¾Ñ§·ÅÒÂ·ÕèãËé¤èÒÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂµèÓ·ÕèÊØ´ [1] «Ö§ÇÔ¸Õ·Õè¹ÔÂÁãªé¡Ñ¹ÁÒ¡ ä´éá¡è ÇÔ¸Õ¢Í§ Fellenius (1927) «Öè§ä´é¾Ô¨ÒÃ³ÒÅÑ¡É³Ð

	
ÃÙ»·Õè 1 á¼¹¼Ñ§¡ÒÃáºè§ªÔé¹´Ô¹	ÃÙ»·Õè 2 á¼¹¼Ñ§ Free Body Diagram ¢Í§áÃ§·Õè¡ÃÐ·Ó

ã¹¡ÒÃáºè§ªÔé¹´Ô¹à»š¹ªÔé¹àÅç¡æ ¨Ò¡¹Ñé¹¨Ö§¾Ô¨ÒÃ³ÒáÃ§·Õè¡ÃÐ·ÓµèͪԹ´Ô¹á µèÅÐªÔé¹ ã¹ÊÁ¡ÒÃ¤èÒ¤ÇÒÁ»ÅÍ´ÀÑÂ ËÒ¤èÒ¤ÇÒÁ»ÅÍ´ÀÑÂ«Öè§àÃÕÂ¡ÇèÒ ÇÔ¸Õ ¢Í§ ÃÙ»ÃèÒ§ áÅÐ ¤èÒ¤ÇÒÁ»ÅÍ´ÀÑÂ ¨Ò¡¡ÒÃ¾Ô¨ÒÃ³ÒÊÁ´ØÅ¢Í§ Moment à¾Õ§ÍÂèÒ§à´ÕÂÇ ¨Ò¡¹Ñé¹ä´éÁÕ¡ÒÃ¾Ñ²¹ÒÇÔ¸Õ Bishop (1955) ¾Ô¨ÒÃ³Ò áÃ§áÅÐÊÁ´ØÅ¢Í§ Moment ã¹µÓáË¹è§µèÒ§æ áÅÐÂÑ§¾Ô¨ÒÃ³ÒáÃ§·Õè¡ÃÐ·Ó´éÒ¹¢éÒ§¢Í§ á·§´Ô¹ ¾Ô¨ÒÃ³Ò¨Ò¡ÇÔ¸Õ¢Í§ Morgenstern and Price (1965, M/P) ¹Ñé¹ã¹»˜¨¨ØºÑ¹ ¶×ÍÇèÒà»š¹ÇÔ¸Õ·ÕèãËé¼Å¶Ù¡µéÍ§ ·Õè ÊØ´ áµè¨ÐµéÍ§ãªé¤ÍÁ¾ÔÇàµÍÃìªèÇÂ ã¹¡ÒÃ¤Ó¹Ç³ËÒ¤èÒ ä´é·Ñ¹·Õ »˜¨¨ØºÑ¹ÁÕ¡ÒÃãªé§Ò¹ÇÔ¸Õ¢Í§ Bishop à»š¹ËÅÑ¡ ã¹¡ÒÃ ¤Ó¹Ç³ËÒ¤èÒµèÓÊØ´¢Í§ÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂ ¡ÒÃ¾Ñ§·ÅÒÂ·ÕèÊØ´ ¢Í§ ¼ÔÇ¡ÒÃ¾Ñ§·ÅÒÂ ·Õè¤Ò´ÇèÒ¨Ðà¡Ô´ ¢Ö é¹ ËÅÑ§¨Ò¡ ä´é ¤èÒ ÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂ ·Õè ÊØ´ ¤ÇÃµÃÇ¨ÊÍº ¤ÍÁ¾ÔÇàµÍÃì ªèÇÂ ã¹¡ÒÃ ÇÔà¤ÃÒÐËì »˜¨¨ØºÑ¹ ÁÕâ»Ãá¡ÃÁ ÊÓàÃç¨ÃÙ» ·Õèãªé¤Ó¹Ç³ ÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹ ËÅÒÂ â»Ãá¡ÃÁ ã¹·Õè¹Õé ä´é¹ÓâÁÒ ãªé â»Ãá¡ÃÁ·Õèãªé ·´Êͺ »ÃÐ¡Íº´éÇÂ â»Ãá¡ÃÁ SLOPE/W 3.03 , SB-SLOPE 2.0 , XSTABL 5.0 ¾Ñ²¹Òâ´Â PCSTABL 5M¢Í§ Purdue University áÅÐ KUslope 1.0 ¾Ñ²¹Òâ´Â RE5 â´Â¤³Ð ÇÔÈÇ¡ÃÃÁÈÒÊµÃì ÁËÒÇÔ·ÂÒÅÑÂà¡ÉµÃÈÒÊµÃì

3.ÇÔ¸Õ¡ÒÃáÅÐÁÒµÃ°Ò¹·Õè㪌㹡ÒÃ·´ÊÍº

ã¹¡ÒÃ·´ÊÍºâ»Ãá¡ÃÁä´é¡Ó˹´¢Íºà¢µ¢Í§¡ÒÃ·´ÊÍºä·Õ觢Ñé¹µÍ¹¡ÒÃ·´ÊÍºµÒÁ¤Ø³ÊÁºÑµÔ·Õèµéͧ¡ÒÃ·´ÊÍº ÁÕÃÒÂÅÐàÍÕ´´Ñ§¹Õé

µÒÃÒ§·Õè 2 ÇÔ¸Õ¡ÒÃ·Õè㪌㹡ÒÃ·´ÊÍº

ÇÔ¸Õ¡ÒÃ·´ÊÍº	Ê觷Õè·´ÊÍº
1.ÃٻẺ¡ÒÃµÔ´µèÍ¡Ñºã¹ (User Interface)	1. ÃٻẺÇÔ¸Õ¡ÒÃ㪌§Ò¹à¢éÒ㨧èÒÂËÃ×ÍäÁè 2. ¤ÇÒÁÂ×´ËÂØè¹ã¹¡ÒÃ»é͹¢éÍÁÙÅà¾×èÍãËé¤ÃºµÒÁ¤ÇÒÁµéͧ¡Òà 3. ¤ÇÒÁÊÐ´Ç¡ã¹¡ÒÃá¡é䢢éÍÁÙÅ
2.¤ÇÒÁÊÒÁÒö㹡ÒäӹdzÁ	ã´Âà»ÃÕºà·ÕºÇ¸Õ¡ÒäӹdzÁ¢Í§â»Ãá¡ÃÁ ¡Ñº¼Å¡ÒäӹdzÁ¢Í§ M/P ¨Ò¡¼Å¡ÒÃÇÔà¤ÃÒÐË쪹Ô´¢Í§¡ÒÃ¾Ñ§·ÅÒÂ
3.¤ÇÒÁàÃçÇ㹡ÒäӹdzÁ	à»ÃÕºà·Õº¤ÇÒÁàÃçÇ㹡ÒäӹdzÁ â´ÂãªéàÇÅÒ ¡Ã³Õ·Õè¡Ó˹´ Åѡɳеѧ ÃٻẺµèÒ§æ ¢Í§¡ÒÃ¾Ñ§·ÅÒ
4.»ÃÐÊÔ·¸ÔÀÒ¾¢Í§¡ÒÃáÊ´§¼Å	¤ÇÒÁ¶Ù¡µéͧ¢Í§¡ÒÃ¤Ó¹Ç³ ¤ÇÒÁªÑ´à¨¹¢Í§¡ÒÃáÊ´§¼Å
5.¤ÇÒÁÊÒÁÒö㹡ÒäӹdzËÒ¤èÒ FS. ·Õè¹éÍ·ÕèÊØ´	¤ÇÒÁÊÒÁÒöã¹Ç¡ÒÃËҼŤèÒ FS. ·ÕèµèÓÊØ´ ¤ÇÒÁàÃçÇã¹¡ÒäӹdzÁ

4.áÊ´§¼Å¡ÒÃà»ÃÕºà·Õº¢éÍ´Õ¢éÍàÊÕ¢Í§â»Ãá¡ÃÁ

¨Ò¡¡ÒÃ·´ÊÍºâ»Ãá¡ÃÁ ÊÒÁÒö¶ÖʶÃØ»¼Å¡ÒÃà»ÃÕºà·Õº¢éÍ´Õ¢éÍàÊÕ¢Í§â»Ãá¡ÃÁä´é´Ñ§¹Õé

µÒÃÒ§·Õè 3 ¼Å¡ÒÃà»ÃÕºà·Õº¢éÍ´Õ¢éÍàÊÕ¢Í§â»Ãá¡ÃÁÇÔà¤ÃÒÐË쪹Ô´¢Í§¡ÒþѧÅÒÂ

¢éÍà»ÃÕºà·Õº	SLOPE/W	SB-SLOPE	XSTABL	KUslope
ÃٻẺ¡ÒÃµÔ´µèÍ¡Ñºã¹ (User Interface)				
- ¤ÇÒÁ§èÒÂã¹¡ÒÃàÃÕ¹ÃÙé㪌§Ò¹	3	5	4	4
- ¡ÒÃ»é͹¢éÍÁÙÅ (Input)	4	3.5	3.5	4
- ¡ÒÃãÊè¢éÍÁÙÅ (Insert geometry)	4.5	2	4	4
- ÃٻẺ㹡ÒÃÊÃéÒ§ Geometry	3.5	3	4	4
¤ÇÒÁÊÒÁÒö㹡ÒäӹdzÁ				
- ¤ÇÒÁÊÒÁÒö㹡ÒÃáºè§ªÔé¹ ¢Í§ÁÇÅ´Ô¹	4	2	NA	5
- ¤ÇÒÁ¶Ù¡µéͧ¢Í§¤ÇÒÁ»ÅÍ´ÀÑ	SB-SLOPE > XSTABL > SLOPE/W > KUslope			
¤ÇÒÁàÃçÇ (Speed)				
- ¤ÇÒÁàÃçÇ㹡ÒäӹdzÁ	3	2	2.5	5
- ¤ÇÒÁàÃçÇ㹡ÒÃ Input ¢éÍÁÙÅ (ÊÃéÒ§ Geometry)	3.5	3	4	4
»ÃÐÊÔ·¸ÔÀÒ¾¢Í§¡ÒÃáÊ´§¼Å	5	3.5	3	3
¤ÇÒÁÊÒÁÒö㹡ÒÃËÒ¤èÒ FS. ·Õè¹éÍ·ÕèÊØ´	4	3	3.5	5
¤ÇÒÁÊÒÁÒö¾ÔàÈÉÍ×è¹æ (Other Features)				
- ¤ÇÒÁÊÒÁÒö㹡ÒÃµÃǨÊͺ¢éͼԴ¾ÅÒ´ ¨Ò¡¡ÒÃÊÃéÒ§ Geometry	√	√	×	×
- Tension Crack	√	√	√	×
- Phreatic Line	√	√	√	√
- Anisotropic	√	×	√	×
- Reinforcement	√	×	√	×
- Grid of Pore Pressure	√	×	√	×
- Point Load	√	×	×	×
ÃÒ¤Ò (Price) [2]	3495 $	625 $	540 $	-

¡ÒÃãËé¤Ðá¹¹¤ÇÒÁÊÒÁÒö¢Í§áµèÅÐâ»Ãá¡ÃÁ 5 ÃдѺ ´Ñ§¹Õé

5 = ´ÕÁÒ¡

4 = ´Õ

3 = »Ò¹¡ÅÒ§

2 = ¾Íãªé

1 = ãªéäÁèä´é

- *ÃٻẺ¡ÒõԴµèÍ¡Ñºã¹ (User Interface)*

- SLOPE/W ÁÕ¢éÍ´Õ¤×Í ¡ÒÃàÃÔè¹ Boundary Line ÁÕ¤Ø³ÊÁºÑµÔ ¨ÐÊÒÁÒöÅÒ¡àÁÒÊìä»ÂѧµÓáË¹è§ ·Õè Boundary Line ¨ÐµÑ´¡Ñ¹ä´é·Ñ¹·Õ áÅШеÃǨÊͺ¢éͼԴ¾ÅÒ´ä´é [3] «Öè§à»ç¹¡ÒÃÍӹǤÇÒÁÊдǡ㹡ÒÃÊÃéÒ§ äÁèµéͧ¡ÒÃÊÃéÒ§ Geometry ÃٻẺ·Õè¶Ù¡µéͧ¨Ò¡ÃÙ»·Õè 1.ãªé mouse 㹡ÒÃÃкØãËé§èÒ¢Öé¹

º¹ Boundary Line «Öè§ËÁÒÂ¶Ö§àÊé¹áºè§ªÑé¹´Ô¹ – áÅÐ2.â´Â¡ÒÃ¡ÃÍ¡¢éÍÁÙÅ¾Ô¡Ñ´¨Ø´µÑ´µèÒ§

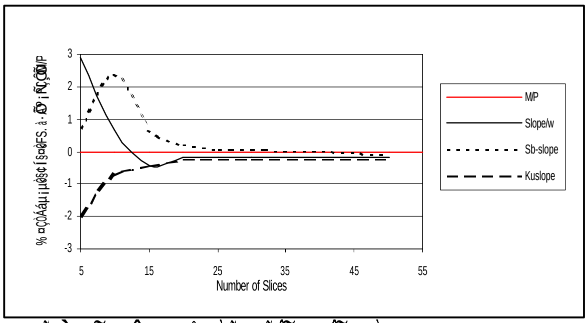
- SB-SLOPE ÁÕÇÔ¸Õ¡ÒÃã¹¡ÒÃÊÃéÒ§ Geometry â´Â¡ÒÃ¡ÓË¹´àÊé¹ Line segment áÅÐµÓá¹è§¨Ø´µÑ´µèÒ§ ´Ñ§¹Ñé¹ Line segment «Öè§à»ç¹àÊé¹·Õèà¡Ô´¨Ò¡¡ÒÃàª×èÍÁ¨Ø´ÃÐËÇèÒ§ 2 ¨Ø´ áÅÐã¹¡ÒÃ¡ÓË¹´ªÑé¹´Ô¹ ÃÐËÇèÒ§ Line segment µéÍ§¡ÓË¹´ãËéµÃ§¡Ñ¹¡Ñº¨Ø´¢Í§ Line segment ¹Ñé¹ áÅÐµéÍ§ÃÐºØ Line segment ·Õè໚¹á¹Ç´Ô¹´éÇÂ

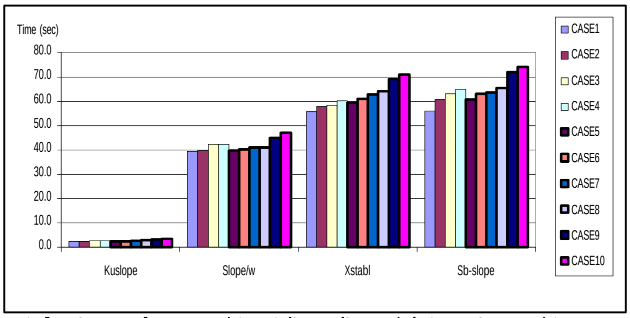
- XSTABL ÁÕÇÔ¸Õ¡ÒÃã¹¡ÒÃÊÃéÒ§ Geometry â´Â¡ÒÃ¡ÓË¹´àÊé¹ Surface Boundary áÅÐ Subsurface Boundary «Öè§·Ñé§ÊÍ§àÊé¹¨ÐµéÍ§ÁÕ¡ÒÃàª×èÍÁµèÍ¡Ñ¹

- KUslope ÁÕÇÔ¸Õ¡ÒÃã¹¡ÒÃÊÃéÒ§ Geometry â´Â¡ÒÃ¡ÓË¹´àÊé¹ Bottom Line áÅÐ Boundary Line ·ÕèËÁÒÂ¶Ö§àÊé¹ã¹¡ÒÃ¡ÓË¹´¢Íº¢Í§ªÑé¹´Ô¹ áÅÐ¨Ð¡ÒÃ¡ÓË¹´¢Íº¢Í§ªÑé¹´Ô¹ áµè¡µèÒ§¡Ñ¹ â»Ãá¡ÃÁ¨ÐÃÙé¢Íº¢Í§´Ô¹ÃÐËÇèÒ§ Boundary Line ¢Í§ÁÑ¹[4]

- *¤ÇÒÁÊÒÁÒÃ¶ã¹¡ÒÃ¤Ó¹Ç³*

¤ÇÒÁÊÑÁ¾Ñ¹¸ìÃÐËÇèÒ§¤èÒÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂ¡Ñº¨Ó¹Ç¹áÇ¹´Ô¹ã¹â»Ãá¡ÃÁ KUslope ÊÒÁÒÃ¶ãËé¼ÅÅÑ¾¸ìÊÙ§ÊØ´áÅÐ¨ÐäÁèà»ÅÕèÂ¹á»Å§¨Ò¡¤èÒ M/P àÁ×èÍ «Öè§à»ç¹¤èÒ·Õè¨ÐäÁèà»ÅÕèÂ¹á»Å§µèÍä»µÒÁ¨Ó¹Ç¹áÇ¹´Ô¹ ã¹¢³Ð·Õè â»Ãá¡ÃÁ SB-SLOPE áÅÐ SLOPE/W ¨Ðµéà§ã¹¡ÒÃ¤Ó¹Ç³¨Ó¹Ç¹áÇ¹´Ô¹ ¨ÐÁÕ¤èÒÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂ·ÕèÊÙ§¡ÇèÒ M/P «Öè§à»ç¹¼ÅÁÒ¨Ò¡ ÍÑµÃÒÊèÇ¹¤ÇÒÁ»ÅÍ´ÀÑÂ¢Í§â»Ãá¡ÃÁ KUslope ÊÒÁÒÃ¶ãËé¤èÒ·ÕèãÅéà¤ÕÂ§¡Ñº Algorithm ·ÕèãªéÍÂÙèã¹â»Ãá¡ÃÁ ¤×Í â»Ãá¡ÃÁ¨Ð·Ó¡ÒÃáºè§ Slice à¾ÔèÁ¢Öé¹àÃ×èÍÂ æ ¨¹¡ÃÐ·Ñè§¼ÅÅÑ¾¸ìà»ÅÕèÂ¹á»Å§ ¤ÇÒÁªÑ´à¨¹à»ÅÕèÂ¹á»Å§¹éÍÂ





ÃÙ»·Õè áÊ´§¼Å¡ÒÃà»ÃÕÂºà·ÕÂº¤èÒ Factor of Safety ¢Í§áµèÅÐâ»Ãá¡ÃÁà·ÕÂº¡Ñº·Ä©®Õ M/P

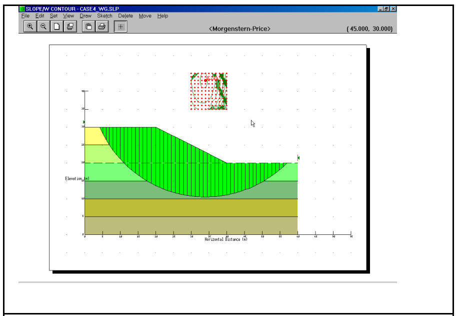
ÃÙ»·Õè áÊ´§¼Å¡ÒÃà»ÃÕÂºà·ÕÂºàÇÅÒ·ÕèãªéÍÑµÃÒ¡ÒÃ¤Ó¹Ç³¢Í§áµèÅÐâ»Ãá¡ÃÁ

- *¤ÇÒÁàÃçÇã¹¡ÒÃ¤Ó¹Ç³*

¼Å¨Ò¡¡ÒÃ·´ÊÍºã¹ÃÙ»·Õè áÊ´§ãËéàË็¹ÇèÒ â»Ãá¡ÃÁ KUslope ãªéàÇÅÒã¹¡ÒÃ¤Ó¹Ç³¹éÍÂ·ÕèÊØ´à¾ÃÒÐ ãªéàÇÅÒ¹éÍÂ¡ÇèÒâ»Ãá¡ÃÁÍ×è¹æ ÁÒ¡ à¹×èÍ§¨Ò¡ã¹ÊèÇ¹·ÕèàÍÒäÇé ¡ÒÃ¤Ó¹Ç³¢Í§â»Ãá¡ÃÁ KUslope ãªéÀÒÉÒ C ã¹¡ÒÃà¢ÕÂ¹â»Ãá¡ÃÁ áÅÐâ»Ãá¡ÃÁÁÕ Algorithm ã¹¡ÒÃ¤Ó¹Ç³·Õè«Ñº«é͹¹éÍÂ¡ÇèÒ·Ó ãËé¡ÒÃ¤Ó¹Ç³àÃçÇ¡ÇèÒ áÅÐ¤ÇÒÁÊÒÁÒÃ¶¢Í§à¤Ã×èÍ§¤ÍÁ¾ÔÇàµÍÃìã¹¡ÒÃ¤Ó¹Ç³µèÒ§æ «Öè§·ÕèÁÕ¼ÅµèÍàÇÅÒ ã¹¡ÒÃ¤Ó¹Ç³ ¨Ó¹Ç¹¢Í§¤ÍÁ¾ÔÇàµÍÃì·Õèãªé»ÃÐÁÇÅ¼Åä´é

- *»ÃÐÊÔ·¸ÔÀÒ¾¢Í§¡ÒÃáÊ´§¼Å*

ÃÙ»áºº¢Í§¡ÒÃáÊ´§¼Å ã¹áµèÅÐâ»Ãá¡ÃÁ ¶×ÍÇèÒ¾ÍãªéµèÍ¤ÇÒÁµéÍ§¡ÒÃã¹¡ÒÃãªé§Ò¹ â´Â·ÕèâปÃá¡ÃÁ



ÃÙ»·Õè ¡ÒÃáÊ´§¼Å¢Í§â»Ãá¡ÃÁ SLOPE/W

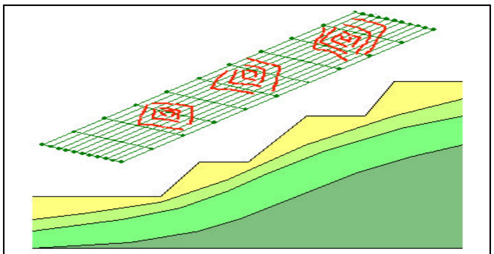
SLOPE/W ¨ÐÁÕÃÙ»áºº¢Í§¡ÒÃáÊ´§¼Å·ÕèªÑ´à¨¹ ÊÒÁÒÃ¶áÊ´§ÊÕµÒÁ¤ÇÒÁÅÖ¡ ÍÕ¡·Ñé§Âѧ¡Ó˹´ÃÐÂÐä´é áÊ´§Contour¢Í§¤èÒF.S.áÅÐÂѧÊÒÁÒÃ¶ àÅ×Í¡ÇÔ¸Õ¡ÒÃÇÔà¤ÃÒÐËì䴌ËÅÒÂÇÔ¸Õ ÊèǹSB-SLOPE ·ÕèÊÒÁÒÃ¶áÊ´§Grid¢Í§¤èÒF.S.ä´é à¾Õ§áµèKUslopeáÅÐ XSTABL ¹Ñé¹¡ÅѺäÁèÁÕ¡ÒÃáÊ´§ KUslope ¹ÑéªÊÒÁÒÃ¶áÊ´§ÊÕµÒÁª¹Ô´¢Í§ªÑé¹´Ô¹ä´é áÅÐ XSTABL ÊÒÁÒÃ¶áÊ´§¡ÒÃÊäÅ´µÑÇ¢Í§ ¡ÒÃà¤Å×è͹¾Ñ§ä´é¤Ãº¶éǹ

- ¤ÇÒÁÊÒÁÒÃ¶ã¹¡ÒÃËÒ¨Ø´Í§ÈÙ¹Âì¡ÅÒ§¢Í§áÃ§

ã¹â»Ãá¡ÃÁ·Ñé§ÊÕè¾ÒµÒÁÇÔ¸Õ¡ÒÃËÒ¨Ø´ÈÙ¹Âì¡ÅÒ§ 4 ÃÙ»áºº¤×Í

1.áººÃÐºØ¨Ø´ÈÙ¹Âì (Specified Point) â´ÂÃкبش·Õè¨ÐËÒ¤èÒ¤ÇÒÁ»ÅÍ´ÀÑ Ç¤ÇÒÁ»ÅÍ´ÀÑ ·ÕèäÁèÁÒ¡ ¹Ô¸Ò¹¤ÇÒÁ¡ÃÐ«Ñ觨ӡѴ¡ÒÃÇÔà¤ÃÒÐËì¡ÅÑº (Back Analysis) «Öè§ÊÒÁÒöãªé䴌·Ø¡â»Ãá¡ÃÁ

2.áºº¤é¹ËÒ»Ãѧ¢èÒ (Grid Search) â´Â¡ÒÃÊÃéÒ§Grid à»ç¹¨Ø´ÈÙ¹Âì¡ÅÒ§¢Í§ÇÔ§¡ÅÁ¡ÒÃà¤Å×è͹¾Ñ§«Öè§ÊÒÁÒöãªéä´éã¹â»Ãá¡ÃÁ SLOPE/W, SB-SLOPE áÅÐKUslope â´Â·Õè SLOPE/WáÅÐKUslope ¨ÐÁÕ¤ÇÒÁÊдǡ¡Ç‹Ò·Õè ´Õ¡ÇèÒ㹡ÒÃÊÃéÒ§Grid ÍÕ¡·Ñé§ÂѧÊÒÁÒöáººµèÒ§æ ä´éµÒÁ·Õè¼ÙéãªéµéͧÃÙ¡ÒÃ



ÃÙ»·Õè áÊ´§¢Í§¡ÒÃÇÔà¤ÃÒÐËì ¸ÃÃÁªÒµÔ

¸ÃÃÁªÒµÔ·Õè¨ÐÁÕ¡ÒÃÂÑ´¤èÒF.S.µèÓ¡ÇèÒ¤ÇÒÁ¨ÃÔ§¨Ò¡ÊÀÒ¾·ÕèáÅéÇ¡ÒÃ㪹͡â»Ãá¡ÃÁKUslope¹Ñé¹¨ÐÁÕ¤ÇÒÁÊÒÁÒöÁÒ¡·ÕèÊÙ´ ¤×Í àÁ×èÍä´é¤èÒF.S.¨Ò¡¡ÒäӹdzâÃ§¡ÒÃá¡éä¢áÅéÇâ»Ãá¡ÃÁ¨Ð·Ó ¡ÒäӹdzãËÁè¨¹¡ÇèÒ¨Ðä´é ¤èÒF.S.·Õè¹éÍÂÊØ´ ¤èÒF.S.·ÕèµèÓÊØ´ ·Õè «Öè§ÁÕµÑǧ¡Ñºâ»Ãá¡ÃÁÍ×è¹ ·Õè¢Í§F.S.·ÕèÁÒ¡¨¹·Ó¨Ðäªé àÁ×èÍ¨Ø´¡¨Ø´ÈÙ¹Âì¢Í§¨Ø´ÈÙ¹Âì¡ÅÒ§¢Í§ÇÔ§¡ÅÁ ·ÕèÁÕ¡ÒÃà¤Å×è͹·ÕèµÑÇàµÔÁ¤èҢͧÁØÁÃдѺÃÐËÇèÒ§¢èÒ ã¹á¹Ç¡¹Xáŋá¹Y

3.áººÍѵâ¹ÁѵÔ (Automatic) ÇÔ¸Õ¹Õé¨ÐÃкب¨Ø´ÈÙ¹Âì¡ÅÒ§¢Í§¡ÒÃà¤Å×è͹ áÅÐ ¤ÇÒÁÅÐàÍÕ´ã¹¡ÒÃà¤Å×è͹ ¨Ò¡¹Ñé¹â»Ãá¡ÃÁ¨Ð·Ó¡ÒÃà¤Å×è͹ ¤èÒÈÙ¹Âì¡ÅÒ§¢Í§áç·Õè·ÓãËéà¡Ô´ÈÙ¹Âì¡ÅÒ§â´Ââ»Ãá¡ÃÁ¨Ð·Ó¡ÒÃà¤Å×è͹ ä´é ¡ÒÃà»ÅÕè¹á»Å§ ¤èÒ·Õè¹éÍ·ÕèÊØ´ ÀÒÂã¹ Çѧ ·Ó§Ò¹äªéáÅФÇÒÁ áÅÐã¹ á¹Ç´Ôè§¨Ð¹Ó¡ÇèÒ¨Ðä´é¤èÒ·Õè¹éÍÂÊØ´¢Í§ÈÙ¹Âì¡ÅÒ§ ¹Ñé¹ÊÒÁÒö¹ÓÁÒ㪹¤ÇÒÁÊÒÁÒö¹Õéä´é㹠â»Ãá¡ÃÁ SB-SLOPE áÅÐKUslope

4.áºº¡ÓË¹´àÊé¹·Ò§¢Í§¡ÒÃÇÔºÑµÔ «Öè§ÇÔ¸Õ¹Õé¨ÐÁÕ㹠â»Ãá¡ÃÁ XSTABLE ¤×Í à»ç¹¡ÒáÓ˹´ªèǧ·Õè¨Ðà¡Ô´¡ÒÃà¤Å×è͹¾Ñ§ÀÒÂã¹ÇÔºÑµÔ¹Ñé¹áÅÐÊØ´·éÒ·Õè¨Ðà¡Ô´¢Öé¹áÅÐã¹â»Ãá¡ÃÁ [5] ÇÔ¸Õ¹Õé¨ÐÁÕ»ÃÐ⪹ìÁÒ¡ ã¹¡Ã³Õ·Õè·ÃÒº¡ÒÃ ¡ÓË¹´ äÇé¡ÒÃà¡Ô´¡ÒÃà¤Å×è͹¾Ñ§ÇÔºÑµÔ㹾×é¹·Õè¹Ñé¹æ ·Õè¨Ð·Ó¡ÒÃ ÇÔà¤ÃÒÐËì ¢Í§µÓá˹è§·ÕèÊÒÁÒö¡ÓË¹´ä´é ¢Í§ ¡ÒÃÇÔà¤ÃÒÐËì¢Í§¸ÃÃÁªÒµÔ¢Í§¡ÒÃà¤Å×è͹¾Ñ§µÒÁ·ÕèäÁèµéͧÃкبش¶Ö§¨Ø´ÈÙ¹Âì¡ÅÒ§ ¢Í§áç·Õè

5. ÊÃØ»¼Å

1.Ã٠ẺºÒ¡ÒÃÇÔà¤ÃÒÐËì¢Í§â»Ãá¡ÃÁSB-SLOPE à»ç¹â»Ãá¡ÃÁ·ÕèÊÒÁÒöãªé§Ò¹ä´é§èÒ·ÕèÊØ´ÍÂèÒ§ÁÒ¡

¤Í KUslope áÅÐXSTABLE Ê¹ SLOPE/W ¹Ñé¹µéÍ§ãªéÃÐÂÐàÇÅÒã¹¡ÒÃÇÔà¤ÃÒÐËìÁÒ¡¡ÇèÒ

2. ¤ÇÒÁÊÒÁÒÃ¶ã¹¡ÒÃ¤Ó¹Ç³ â»Ãá¡ÃÁKUslope ÁÕ¤ÇÒÁÊÒÁÒÃ¶ã¹¡ÒÃ¤Ó¹Ç³¤èÒ¤ÇÒÁ»ÅÍ´ÀÑÂ¤èÒF.S. ·ÕèµèÓ·ÕèÊØ´ ¤èÒµèÓ·ÕèÊØ´ Ê¹ â»Ãá¡ÃÁSB-SLOPE ¹Ñé¹ä´é¤èÒ·ÕèÊÙ§¡ÇèÒ â»Ãá¡ÃÁSLOPE/W ÁÕ¤ÇÒÁÊÒÁÒÃ¶ÁÒ¡¡ÇèÒ

3. ¤ÇÒÁàÃçÇã¹¡ÒÃ¤Ó¹Ç³ â»Ãá¡ÃÁKUslope ÁÕ¤ÇÒÁàÃçÇã¹¡ÒÃ¤Ó¹Ç³ÊÙ§·ÕèÊØ´µÒÁÁÒ´éÇÂSLOPE/W, XSTABL áÅÐSB-SLOPE µÒÁÅÓ´Ñº

4. »ÃÐÊÔ·¸ÔÀÒ¾¢Í§¡ÒÃáÊ´§¼Å â»Ãá¡ÃÁSLOPE/W ÁÕ¤ÇÒÁâ´´à´è¹·ÕèÊØ´ Ê¹ â»Ãá¡ÃÁ·ÕèàËÅ×ÍÁÕ¤ÇÒÁÊÒÁÒÃ¶·Ñ´à·ÕÂÁ¡Ñ¹

5. ¤ÇÒÁÊÒÁÒÃ¶ã¹¡ÒÃ¤Ñ¹ËÒ¤èÒ¤ÇÒÁÁÑè¹¤§ Ê¹ ¤ÇÒÁ»ÅÍ´ÀÑÂâ»Ãá¡ÃÁ SB-SLOPE ÁÕ¢éÍ¨Ó¡Ñ´¢Í§¡ÒÃ¤Ñ¹ËÒ¡·Õè áÅÐâ»Ãá¡ÃÁ KUslope ÊÒÁÒÃ¶¤Ñ¹ËÒ ¤èÒ¹éÍÂ·ÕèÊØ´ Ê¹ ¤ÇÒÁ»ÅÍ´ÀÑÂ ä´é·Ø¡ÃÙ»áºº·ÕèÊØ´

6. ¤ÇÒÁÊÒÁÒÃ¶¾Ô¨ÒÃ³Ò ã¹Ê¹ â»Ãá¡ÃÁ SLOPE/W ÁÕ¤ÇÒÁâ´´à´è¹·ÕèÊØ´ ¤×Í ÁÕÇÔ¸Õ¡ÒÃ¤Ó¹Ç³ ËÅÒÂáºº ã¹¡ÒÃÇÔà¤ÃÒÐËìäÁèà»ç¹àªÔ§àÊé¹ áÅÐÃÙ»áºº¡ÒÃ¾Ñ§·ÅÒÂ ·ÕèÊÒÁÒÃ¶»ÃÑºà»ÅÕèÂ¹ä´éËÅÒÂáºº áÅÐÊÒÁÒÃ¶ »ÃÐÂØ¡µìãªé§Ò¹¡Ñºâ»Ãá¡ÃÁÍ×è¹æ ä´é´Õ ¹Í¡¨Ò¡¹Õé ¤×Í XSTABL Ê¹ SB-SLOPE áÅÐ KUslope ¹Ñé¹ÁÕ¤ÇÒÁÊÒÁÒÃ¶ã¡Åéà¤ÕÂ§¡Ñ¹

6. ÊÃØ» ¤ÇÒÁ¤Ô´àËç¹ áÅÐá¹Ç·Ò§ã¹Í¹Ò¤µ

¨Ò¡¼Å¡ÒÃ·´ÊÍºâ»Ãá¡ÃÁ·Õè¤ÇÒÁÊÒÁÒÃ¶ÊÙ§·ÕèÊØ´ ¤×Í â»Ãá¡ÃÁSLOPE/W áµè¡çÁÕÃÒ¤Ò·ÕèÊÙ§ áÅÐ¤ÇÒÁÊÒÁÒÃ¶ËÅÒÂÍÂèÒ§·Õè¨Óà»ç¹µéÍ§ãªé ¨Ö§à»ç¹¡ÒÃÂÒ¡·Õè¨ÐÊÒÁÒÃ¶ ¨Ñ´ËÒÁÒ¡ã¹¡ÒÃãªé§Ò¹â»Ãá¡ÃÁ ¤ÇÃ ¾Ô¨ÒÃ³Ò¶Ö§¤ÇÒÁ¨Óà»ç¹¢Í§§Ò¹·Õè¨ÐãªéÇèÒËÁÒÐÊÁ¡Ñº¤ÇÒÁµéÍ§¡ÒÃËÃ×ÍäÁè

»Ñ¨¨ØºÑ¹â»Ãá¡ÃÁÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾ á·º·Ñé§ËÁ´¶Ù¡¾Ñ²¹Òâ´ÂµèÒ§»ÃÐà·È áÅÐÁÕÃÒ¤ÒÊÙ§ã¹¡ÒÃ¾Ñ²¹Ò à¾×èÍãªé§Ò¹ã¹»ÃÐà·ÈÃÐËÇèÒ§»ÃÐà·È «Öè§¤ÇÒÁÊÒÁÒÃ¶º¹Ò§ÍÂèÒ§ÍÒ¨äÁèÊÍ´¤ÅéÍ§¡ÑºÊÀÒ¾ã¹»ÃÐà·Èä·Â ¨Ö§¤ÇÃÁÕ¡ÒÃ¾Ñ²¹Òâ»Ãá¡ÃÁ·Ò§¸Ã³Õà·¤¹Ô¤ÊÓËÃÑº¡ÒÃ»ÃÐÂØ¡µìãªé ·Ò§ÇÔÈÇ¡ÃÃÁ¢Í§ä·Â¢Öé¹ áÅÐ¾Ñ²¹Ò â»Ãá¡ÃÁà¾×èÍ¡ÒÃÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹ ã´æã¹Í¹Ò¤µ à¾×èÍ¡ÒÃ¹Óä»ãªé RE5 áÅÐä´é¾Ñ²¹ÒµèÍàÂÍ§ à¹×èÍ§¨Ò¡ÁÕàÇÅÒ¨Ó¡Ñ´ â»Ãá¡ÃÁ KUslope ã¹»Ñ¨¨ØºÑ¹ «Öè§à»ç¹¹Ñé¹ÊÒÁÒÃ¶ãªé¡Ñº Window95/98/NT áÅÐÊÒÁÒÃ¶ ãªé§Ò¹ä´é¡Ñº¤ÍÁ¾ÔÇàµÍÃì ã¹¡ÒÃÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹·Õè»Ñ¨¨ØºÑ¹ÁÕãªéÍÂèÒ§á¾ÃèËÅÒÂ

àÍ¡ÊÒÃÍéÒ§ÍÔ§

1. ÇÃÒ¡Ã äÁéàÃÕÂ§, ÇÔÈÇ¡ÃÃÁ¾×é¹°Ò¹ ÀÒ¤ÇÔªÒÇÔÈÇ¡ÃÃÁâÂ¸Ò ¤³ÐÇÔÈÇ¡ÃÃÁÈÒÊµÃì ÁËÒÇÔ·ÂÒÅÑÂà¡ÉµÃÈÒÊµÃì, Ë¹éÒ 1-17, 2541.
2. The Geotechnical and Geoenvironmental Software Directory, http://www.ggsd.com
3. User's Guide SLOPE/W for slope stability analysis Version 3, GEO-SLOPE International Ltd. Calgary, Alberta, Canada, p.84-91, 1995.
4. ¤Ù¤Á×Í¡ÒÃãªé§Ò¹â»Ãá¡ÃÁÇÔà¤ÃÒÐËìàÊ¶ÕÂÃÀÒ¾¢Í§ÅÒ´´Ô¹KUslope, ¤³ÐÇÔÈÇ¡ÃÃÁÈÒÊµÃì Á.à¡ÉµÃÈÒÊµÃì, Ë¹éÒ 35-40, 1999.
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