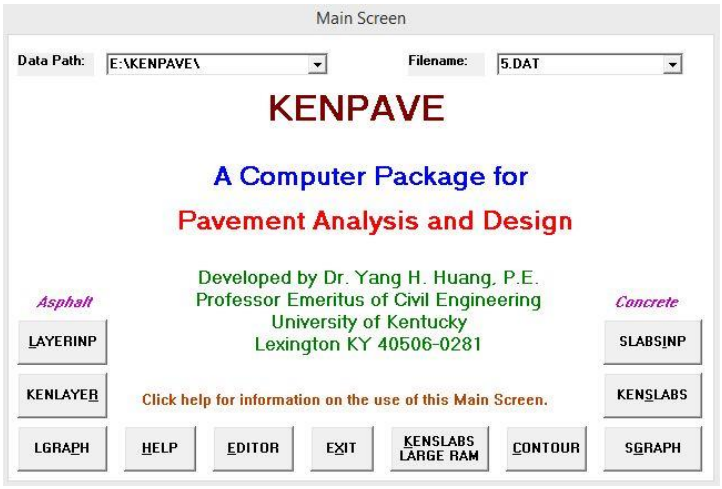
ภาคผนวก ค

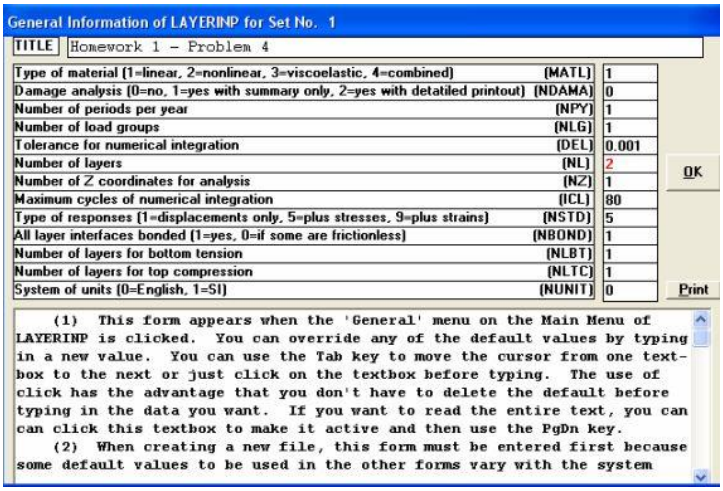
การใช้งานโปรแกรม KENPAVE

โปรแกรม KENPAVE เป็นโปรแกรมที่ไว้คำนวณหาค่า Strain บริเวณรอยต่อของชั้นทาง โดยขั้นตอนการใช้โปรแกรมดังรูปที่ ค.1 และใช้รูปแบบของชั้นทางและพารามิเตอร์ต่างๆดังรูปที่ ค.2 แล้วมีขั้นตอนการดำเนินการดังนี้

1. กำหนดชั้นความหนาของชั้นทางแต่ละชั้น
2. กำหนดค่าอีลาสติกและอัตราส่วนปัวซอง
3. กำหนดลักษณะเพลารถ แรงดันลมยาง น้ำหนักโหลด
4. กรอกค่าต่างๆลงในโปรแกรมตามขั้นตอนดังรูปที่ ค.1
5. หลังจากนั้นโปรแกรมจะแสดงค่า Strain บริเวณรอยต่อของชั้นต่างๆ



(ก)



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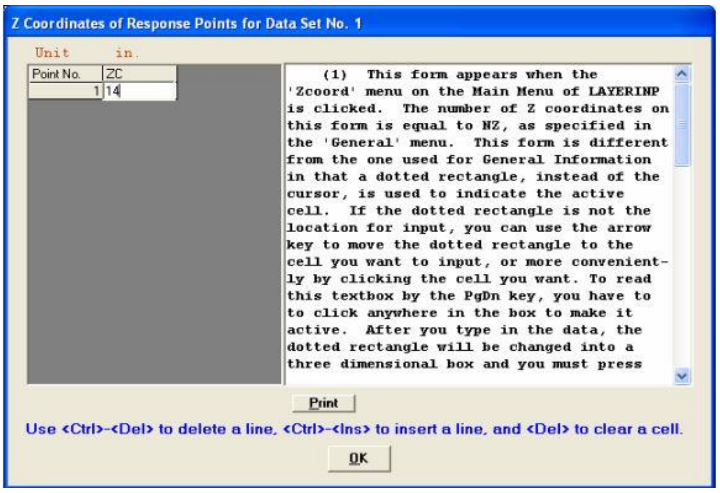
Z Coordinates of Response Points for Data Set No. 1
Unit in.
Point No.
ZC
1
14
(1) This form appears when the 'Zcoord' menu on the Main Menu of LAYERINP is clicked. The number of Z coordinates on this form is equal to NZ, as specified in the 'General' menu. This form is different from the one used for General Information in that a dotted rectangle, instead of the cursor, is used to indicate the active cell. If the dotted rectangle is not the location for input, you can use the arrow key to move the dotted rectangle to the cell you want to input, or more conveniently by clicking the cell you want. To read this textbox by the PgDn key, you have to to click anywhere in the box to make it active. After you type in the data, the dotted rectangle will be changed into a three dimensional box and you must press
Print
Use <Ctrl>-<Del> to delete a line, <Ctrl>-<Ins> to insert a line, and <Del> to clear a cell.
OK

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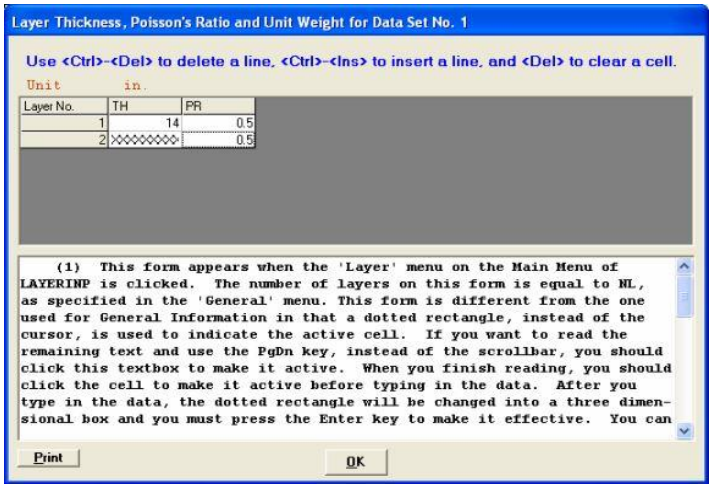
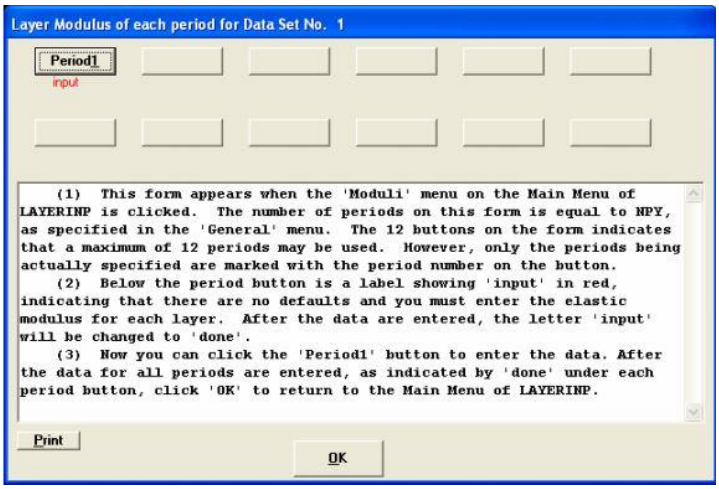

Layer Thickness, Poisson's Ratio and Unit Weight for Data Set No. 1
Use <Ctrl>-<Del> to delete a line, <Ctrl>-<Ins> to insert a line, and <Del> to clear a cell.
Unit in.
Layer No.
TH
PR
1
14
0.5
2
0.5
(1) This form appears when the 'Layer' menu on the Main Menu of LAYERINP is clicked. The number of layers on this form is equal to NL, as specified in the 'General' menu. This form is different from the one used for General Information in that a dotted rectangle, instead of the cursor, is used to indicate the active cell. If you want to read the remaining text and use the PgDn key, instead of the scrollbar, you should click this textbox to make it active. When you finish reading, you should click the cell to make it active before typing in the data. After you type in the data, the dotted rectangle will be changed into a three dimensional box and you must press the Enter key to make it effective. You can
Print
OK

(ง)


Layer Modulus of each period for Data Set No. 1
Period1
input
(1) This form appears when the 'Moduli' menu on the Main Menu of LAYERINP is clicked. The number of periods on this form is equal to NPY, as specified in the 'General' menu. The 12 buttons on the form indicates that a maximum of 12 periods may be used. However, only the periods being actually specified are marked with the period number on the button.
(2) Below the period button is a label showing 'input' in red, indicating that there are no defaults and you must enter the elastic modulus for each layer. After the data are entered, the letter 'input' will be changed to 'done'.
(3) Now you can click the 'Period1' button to enter the data. After the data for all periods are entered, as indicated by 'done' under each period button, click 'OK' to return to the Main Menu of LAYERINP.
Print
OK

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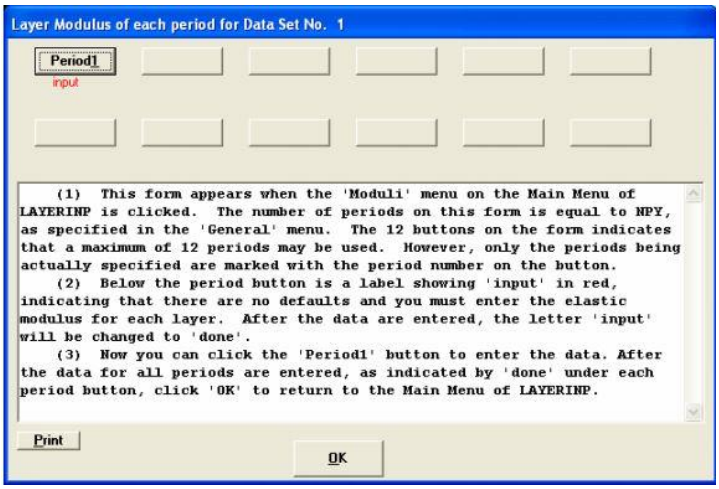
Layer Modulus of each period for Data Set No. 1
Period1
input
(1) This form appears when the 'Moduli' menu on the Main Menu of LAYERINP is clicked. The number of periods on this form is equal to NPY, as specified in the 'General' menu. The 12 buttons on the form indicates that a maximum of 12 periods may be used. However, only the periods being actually specified are marked with the period number on the button.
(2) Below the period button is a label showing 'input' in red, indicating that there are no defaults and you must enter the elastic modulus for each layer. After the data are entered, the letter 'input' will be changed to 'done'.
(3) Now you can click the 'Period1' button to enter the data. After the data for all periods are entered, as indicated by 'done' under each period button, click 'OK' to return to the Main Menu of LAYERINP.
Print
OK

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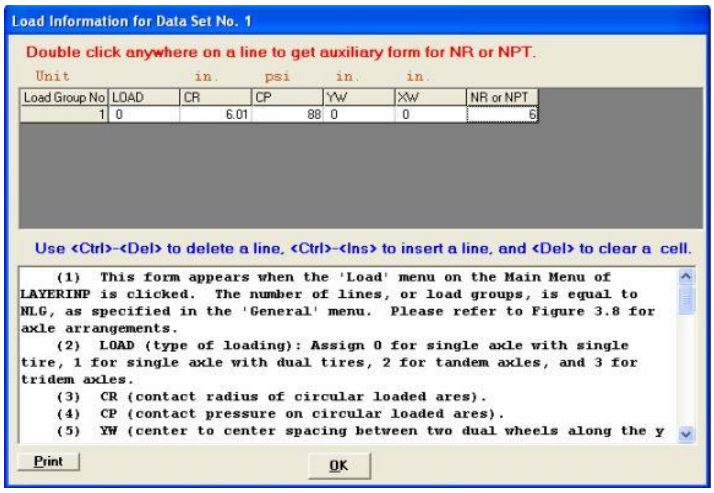
Load Information for Data Set No. 1
Double click anywhere on a line to get auxiliary form for NR or NPT.
Unit in. psi in. in.
Load Group No
LOAD
CR
CP
YW
XW
NR or NPT
1 0 6.01 88 0 0 6
Use <Ctrl>-<Del> to delete a line, <Ctrl>-<Ins> to insert a line, and <Del> to clear a cell.
(1) This form appears when the 'Load' menu on the Main Menu of LAYERINP is clicked. The number of lines, or load groups, is equal to NLG, as specified in the 'General' menu. Please refer to Figure 3.8 for axle arrangements.
(2) LOAD (type of loading): Assign 0 for single axle with single tire, 1 for single axle with dual tires, 2 for tandem axles, and 3 for tridem axles.
(3) CR (contact radius of circular loaded ares).
(4) CP (contact pressure on circular loaded ares).
(5) YW (center to center spacing between two dual wheels along the y
Print
OK

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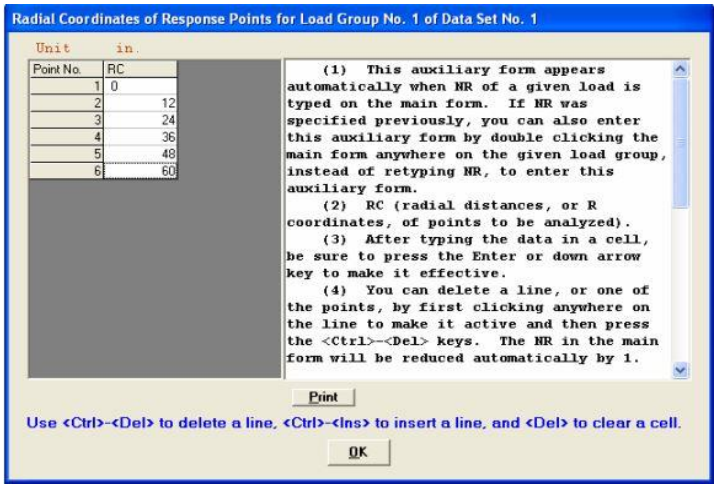
Radial Coordinates of Response Points for Load Group No. 1 of Data Set No. 1
Unit in.
Point No.
RC
1 0
2 12
3 24
4 36
5 48
6 60
(1) This auxiliary form appears automatically when NR of a given load is typed on the main form. If NR was specified previously, you can also enter this auxiliary form by double clicking the main form anywhere on the given load group, instead of retyping NR, to enter this auxiliary form.
(2) RC (radial distances, or R coordinates, of points to be analyzed).
(3) After typing the data in a cell, be sure to press the Enter or down arrow key to make it effective.
(4) You can delete a line, or one of the points, by first clicking anywhere on the line to make it active and then press the <Ctrl>-<Del> keys. The NR in the main form will be reduced automatically by 1.
Print
Use <Ctrl>-<Del> to delete a line, <Ctrl>-<Ins> to insert a line, and <Del> to clear a cell.
OK

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PERIOD NO. 1 LOAD GROUP NO. 1

POINT NO.	VERTICAL COORDINATE	VERTICAL DISPL. (HORIZONTAL P. STRAIN)	VERTICAL STRESS (STRAIN)	MAJOR PRINCIPAL STRESS (STRAIN)	MINOR PRINCIPAL STRESS (STRAIN)	INTERMEDIATE PRINCIPAL STRESS (STRAIN)
1	9.00000	0.07856	369.508	370.506	-393.739	-322.413
	(STRAIN)	-3.012E-04	4.313E-04	4.322E-04	-3.012E-04	-2.327E-04
1	69.01000	0.05174	17.923	18.334	-2.324	-1.716
	(STRAIN)	-2.035E-04	4.798E-04	4.937E-04	-2.035E-04	-1.830E-04
2	9.00000	0.07718	160.105	296.297	-171.233	160.105
	(STRAIN)	-2.276E-04	9.038E-05	2.211E-04	-2.276E-04	9.038E-05
2	69.01000	0.05285	19.009	19.009	-2.459	-1.777
	(STRAIN)	-2.122E-04	5.123E-04	5.123E-04	-2.122E-04	-1.892E-04

POINT NO.	VERTICAL COORDINATE	NORMAL X STRESS (STRAIN)	NORMAL Y STRESS (STRAIN)	SHEAR XY STRESS (STRAIN)	SHEAR YZ STRESS (STRAIN)	SHEAR XZ STRESS (STRAIN)
1	9.00000	-3.937E+02	-3.214E+02	0.000E+00	-2.627E+01	0.000E+00
	(STRAIN)	-3.012E-04	-2.318E-04	0.000E+00	-5.043E-05	0.000E+00
1	69.01000	-2.324E+00	-1.305E+00	0.000E+00	-2.839E+00	0.000E+00
	(STRAIN)	-2.035E-04	-1.691E-04	0.000E+00	-1.917E-04	0.000E+00
2	9.00000	-1.712E+02	2.963E+02	0.000E+00	0.000E+00	0.000E+00
	(STRAIN)	-2.276E-04	2.211E-04	0.000E+00	0.000E+00	0.000E+00
2	69.01000	-2.459E+00	-1.777E+00	0.000E+00	0.000E+00	0.000E+00
	(STRAIN)	-2.122E-04	-1.892E-04	0.000E+00	0.000E+00	0.000E+00

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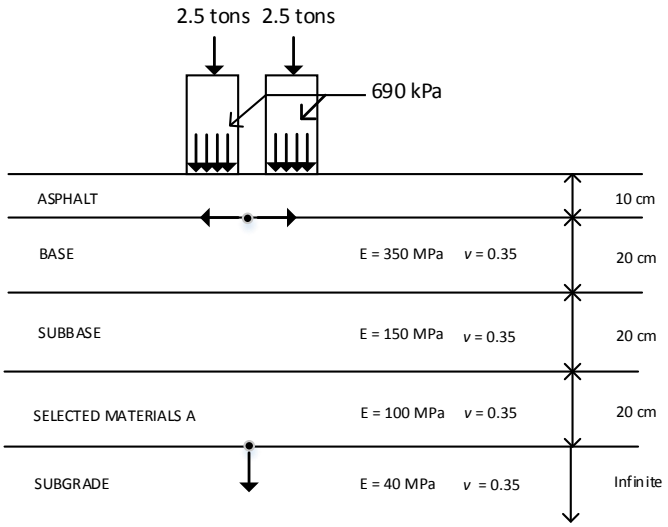
รูปที่ 8.1 (ก) (ข) (ค) (ง) (จ) (ฉ) (ช) (ซ) (ฌ) ขั้นตอนการใช้โปรแกรม KENPAVE

ในการศึกษานี้จะใช้โครงสร้างชั้นทางตามมาตรฐาน (กรมทางหลวงชนบท, 2556) และค่าพารามิเตอร์ต่างๆ ดังรูปที่ ค.2



รูปที่ ค.2 โครงสร้างชั้นทางที่ใช้ในการศึกษาครั้งนี้