บทที่ 10

การติดตามและการประเมินผล

บทที่ 10 การติดตามและการประเมินผล

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34 $" " 5# !) ("
))!)

10.1 การติดตามและประเมินผลหลังการก่อสร้าง

" +" $3;" ! " '2)&
4 " ! ! %! ! " % ! &
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2 2 # & #

) , . " " + ! " &)
) 4 . !1 6 $ '

' 4+" (รูปที่ 10.1-1)

)+& (3 " 7

10.3 การประเมินผล

10.3.1 การทดสอบ Chi-Squared และ Tanner-k Test

% ($&

1. $ %+ , ()*" ! ! "1 %
! "

2. $&$ %+ %(" ! ! " ! "

$% ()* . $ %(! ! "1 1 .
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3 %(! !) &$ "1 ! ". ! ! $ "1
&)) 1 (' 0 5%) (5

2 &)) 1) '2 #))!) & '2 HAIMS P1%) '
(" +

) &2))! (Control) %(! ! "1 & !
" (Treated) (' 10))))! % &%(

2))!) %))) 1 # 2 4 &
') ## % % % $ 5 %% (" 2
) + 4+ <') ' % %
! " (& % crash migration)

10.3.2 การทดสอบแบบ Chi Square

' & & 3 ") , /))! #" +$&0
. Chi-squared '2 ( ) , " ($ 3 . '2
) .

Chi-squared . '2 " ! ! 2 ( )
()* & ' 2 "1 2))!

% (Chi-squared (X^2) . ('2 MS Excel ($& " '%
.% (&

" !

-) % " + 5 ' 2 (P). % ' " ()*
&%) +
-) $ " Yatesks . ('2 " 5 ' 7%!
. 5 % '2 Chi-squared 0 5$ $! %(
! " 5+ & % . %% ()*
- 2))! ( )) % %(! ! 10 " ! "
- $% 5" Regression to the mean Crash Migration '
) !" + ! ! '2 3) "
2 1 % " 5
- &2) '2 0 2) #3 J &
.1 % . $3, J1 . " $ $

+ $&0 " Chi-squared

$$\chi^2 = \sum_{i=1,k=1}^{n,m} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where O_{ij} is the observed value in column j, row i of the table
E_{ij} is the expected value in column j a, row i of the table
m is the number of columns
n is the number of rows

ตัวอย่างการทดสอบ X^2 ก่อน/ หลัง

((Work sheet) " MS Excel ' ( ) X^2 + P)+&

()& (" %(! ! / ' 2 (P) ,2 %)( ) " X^2
%(! !) % " " +))! &

Tanner o k '2 ('2" +))! $&)(" " ! !
$ 3,))! &

Chi-squared '2 $& . " ! ! ()* .
' %(! ! ' KbeforeL KafterL ' 2 (")

Tanner-k test for single site - uses the control data to compute the size of any change in Accidents relative to the control

Chi-squared is used to estimate if any reduction in accidents at the site is statistically significant

Enter the 'before' and 'after' accidents in the cells (white)

The intervention site accidents are distributed differently than the control accidents
The size of change relative to control is 67.7%

period	site	control	site expected count	chi-squ. values
before	20	418	13.5	3.15
after	6	388	12.5	3.39
	26	806	26.0	6.5

Size of Reduction at site =	67.7%	- adjusted for control, Tanner test value
Probability of Sign Difference =	1.05%	- probability that there is a difference between the site before and after accident numbers, allowing for any trend in control

The probability of the Chi-squared value is less than 5% (pink cell), i.e. there is an effect

ตัวอย่างของเวิร์กชีตสำหรับการคำนวณ Chi-squared test

( ) χ^2)&6.5) # ") ()*" !
" 1.05 %

. +) ,), %)(& χ^2 ' แผ่นซีดี (Tanner Test.xls)

(2 x 2 / " /))! χ^2 '2 1 degree of freedom

( ) χ^2 #6.5 ' (1 degree of freedom .) % #
) ()* + 0.02 0.01) % # 5 % (0.05) &K1 ' 20L %
()*

Table of χ^2

Degrees of Freedom, υ	0.99	0.98	0.95	0.90	0.50	0.10	0.05	0.02	0.01	0.001
1	0.000	0.001	0.004	0.015	0.455	2.710	3.840	5.410	6.640	10.830
2	0.020	0.040	0.103	0.211	1.386	4.610	5.990	7.820	9.210	13.820
2	0.	0.	0.	0.	1.386	4.6	5.990			
	0.	0.	0.	0.	1.386	4.6				

10.3.3 การทดสอบแบบ Tanner k

Tanner k Test '2 (%(! ! " +))! '
" " % # $ &

(1 & !" ! "
a = ! !
b = ! !
c = ! !))!
d = ! !))!

$$k = \frac{b/a}{d/c}$$

&.) . #0 ' $ ½ ' 2

$$k = \frac{(b+1/2)\times(c+1/2)}{(a+1/2)\times(d+1/2)}$$

. k<1 ! !))!
. k=1))!
. k>1 ! !$ "1))!
,P5 ;")&(k o 1) x 100 %

ตัวอย่างของ Tanner k test

'2%(! % (% χ^2 ") # ! " Tanner k test " +))!
'2)& ! ! ' 2 3 J 3 J

อุบัติเหตุมีการบาดเจ็บรวม ในช่วงเวลาสามปีบริเวณที่แก้ไขกับบริเวณที่ควบคุม

		))!	
	20 (a)	418 ©	438 (g)
	6 (b)	388 (d)	394 (h)
รวม	**26 (e)**	**806 (f)**	**832 (i)**

Tanner k test % (! - +

Tanner k Test - '2" +))!)(" " ' ! ! $ 3,
))!

Chi squared '2 $& " ! ! ()* &
' " +K L K L ' 2 (")

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The probability of the Chi-squared value is less than 5% (pink cell), i.e. there is an effect

'2) & +"

$$k = \frac{6/20}{388/418} = 0.323$$

$ Q
) k<1 " ! ! $ 3,))!
(k-1) x 100 % = 67.7 % ' (

$ χ^2) " ! !
%))! . ! #%

10.3.4 การวิเคราะห์อื่น ๆ

. " + ! 5 .) , P P "1 2
! !(Crash rates) Pair t-test
" ! (Variance) F-test
(Proportions) z-test
& % (Distribution shifts) Kolmogorov-Smirnov

5) %(") , . #

เอกสารอ้างอิง

AUSTROADS (2004) Treatment of Crash Locations Guide to Traffic Engineering Practice Part 4 Austroads publication AP-G111.4/04, Sydney

BICKEL, P. *et al* (2006) HEATCO deliverable 5. Proposal for harmonised guidelines. 0.195(H)1.5U-project developing harmonised 0.195(H)1.5uropean approaches to transport costing and project assessment (HEATCO). Institut für Energiewissenschaft und Rationelle Energieanwendung, Stuttgart.

ELVIK R. and VAA T. (2004) The Handbook of Road Safety Measures. Elsevier, Amsterdam.

HADDON W. (1980) Advances in the epidemiology of injuries as a basis for public policy. Public Health Reports 95 (5). Association of Schools of Public Health, Washington

OGDEN K.W. (1994) Safer Roads: A Guide to Road Safety Engineering, Ashgate Publishing, Aldershot.

SWEROADS (2001) Guidelines Black Spot Improvement. Guideline No.3, Action Plan Coordination and Pilot Studies on Road Safety. Ministry of Transport and Communications. Thailand.

SWEROADS (2001) Methodologies and Approach for Identification of Black Spots and Rectification. Technical Report No.9, Action Plan Coordination and Pilot Studies on Road Safety. Ministry of Transport and Communications. Thailand.