



# Easy Opening Package Design

## SCV (Song&Choi Victory) Company

### Objectives



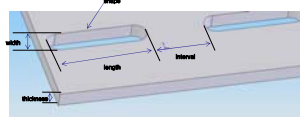
Package.....  
It's not easy to open!!



So, We want find  
1. Optimal design of perforated pattern to open package easily.  
2. Optimal location of perforated line to open package easily.

### Find Optimal Design of Perforated Pattern

- Method : Use **Taguchi method**
- Target  
- 1kg for 0.3mm sheet, 2kg for 0.5mm sheet
- Factor



- Restricted Condition  
- Material : PP and PVC (Area 150mm \* 150mm)  
- Patterns are started at its half shape.  
- Pattern line is a unit with sheet's center line.

Control factor of pattern line	Quantity		
	0	1	2
Shape	Triangle	Circle	Square
Length	1mm	3mm	5mm
Width	1mm	2mm	3mm
Interval	50%	150%	100%

Noise factor of pattern line	Quantity	
	1	2
Material	PP	PVC

We assume there is no interaction in control factor.

Test condition	Test Number	
	1	2
Thickness	0.3mm	0.5mm

Sample Making Condition

Tool Dia : 0.3mm  
Feed Speed : 1.5mm/s  
RPM : 18000Rev/min  
Lubricator : SP5000

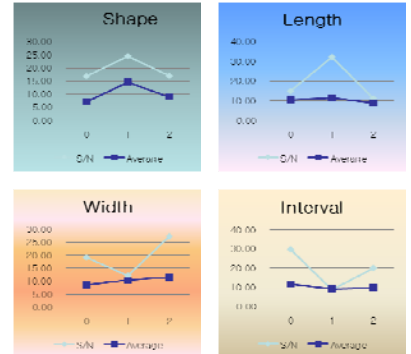
Sample Testing Condition

Speed : 40mm/min  
Max Force : 54kN

### 0.3mm thickness sheet test result

Factor	A	B	C	D	Noise Factor		SN	AVERAGE
					Material	Material		
Name	Shape	Length	Width	Interval	PP	PVC		
Row No.	1	2	3	4				
Test No.								
1	0	0	0	0	6.63	7.41	22.14	7.02
2	0	1	1	1	6.26	9.04	11.65	7.65
3	0	2	2	2	7.32	5.97	16.82	6.65
4	1	0	1	2	12.28	16.67	13.28	14.48
5	1	1	2	0	18.77	18.72	55.27	18.74
6	1	2	0	1	6.80	14.45	5.26	10.63
7	2	0	2	1	7.36	11.74	9.53	9.55
8	2	1	0	2	7.98	8.35	29.80	8.17
9	2	2	1	0	7.50	10.84	11.65	9.17

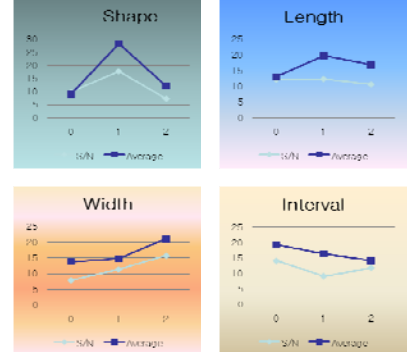
Factor	Level	Value	S/N	Average
Shape	0	◇	16.87	7.11
	1	○	24.60	14.62
	2	□	17.00	8.96
Length	0	1mm	14.98	10.35
	1	3mm	32.24	11.52
	2	5mm	11.24	8.82
Width	0	1mm	19.07	8.60
	1	2mm	12.19	10.43
	2	3mm	27.21	11.65
Interval	0	50%	29.69	11.64
	1	150%	8.81	9.28
	2	100%	19.97	9.76
Max-Min	Max-Min	20.87	2.37	



### 0.5mm thickness sheet test result

Factor	A	B	C	D	Noise Factor		SN	AVERAGE
					Material	Material		
Name	Shape	Length	Width	Interval	PP	PVC		
Row No.	1	2	3	4				
Test No.								
1	0	0	0	0	4.22	6.95	8.96	5.59
2	0	1	1	1	7.37	13.15	7.63	10.26
3	0	2	2	2	9.76	13.39	12.99	11.58
4	1	0	1	2	22.57	18.90	18.03	20.73
5	1	1	2	0	40.28	37.19	24.98	38.74
6	1	2	0	1	30.87	20.23	10.43	25.55
7	2	0	2	1	9.86	16.04	9.18	12.95
8	2	1	0	2	6.07	14.12	4.22	10.09
9	2	2	1	0	9.92	16.89	8.38	13.40

Factor	Level	Value	S/N	Average
Shape	0	◇	9.86	9.14
	1	○	17.81	28.34
	2	□	7.26	12.15
Length	0	1mm	12.06	13.09
	1	3mm	12.28	19.70
	2	5mm	10.60	16.84
Width	0	1mm	7.87	13.74
	1	2mm	11.35	14.80
	2	3mm	15.72	21.09
Interval	0	50%	14.11	19.24
	1	150%	9.08	16.25
	2	100%	11.75	14.13
Max-Min	Max-Min	5.03	5.11	



### Expected Optimal Pattern for the Package

Factor	Level	Expected S/N	Expected Force
Shape	Triangle	47.53 for 3mm sheet 17.03 for 5mm sheet	11.23 for 3mm sheet 19.54 for 5mm sheet
Length	3mm		
Width	3mm		
Interval	1.5mm		

14% over than target force (0.3mm sheet)  
& 0.3% less than target force (0.5mm sheet)



SEOUL NATIONAL UNIVERSITY

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## Manufacturing Method and Productivity

To make the pattern cheaply, we have to punch the sheet before vacuum forming, or install punch on the vacuum forming mold so it can make pattern during vacuum forming.

To punch the sheet, the size of pattern can be big problem because of tolerance. I think our optimal pattern have enough tolerance because of its size and big S/N ratio. So it can be made by punch process.

And the time of punching is depending on the pattern position.

## Manufacturing Cost

### 1. Assumption

- Process : press
- Quantity : 100,000EA
- The process is automatic.
- Calculate the cost of making perforated pattern line only.

### 2. Manufacturing Cost

Factor	Cost(won)	Durability	Cost/EA(won)
R&D	2,000,000	-	20
Tool	3,000,000	1,000,000EA	30
Machine	50,000,000	10 year	4.4
Total			54.4

## Find Optimal Location of Perforated Line

### 1. Analysis Method : Multivariate Statistics

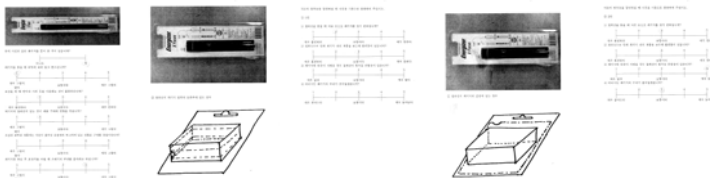
### 2. Evaluation Factor

- use convenience, environmental effect, safety, exhibition

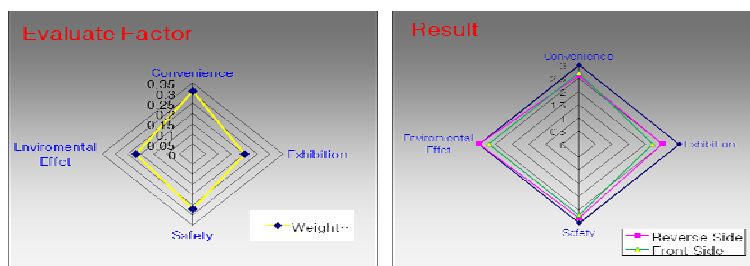
### 3. Respondents

- 20 people in SNU.

### 4. Questionnaire Form



### 5. Result



From the questionnaire,  
We find backside of the package is best location!!