



## ATRANs 2009

# Airport Noise Impact on Property Values: Case of Suvarnabhumi Airport

by:

**Mr. Veng Kheang PHUN**

Advised by:

**Assist. Prof. Dr. Saksith CHALERMPONG**

Transportation Division, Civil Engineering Department,  
Faculty of Engineering, Chulalongkorn University,  
Thailand

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# Outline

- Background
- Motivation/Objective
- Literature Reviews
- Empirical Model
- Results
- Conclusion
- Future Research





# Background

## SUVARNABHUMI AIRPORT

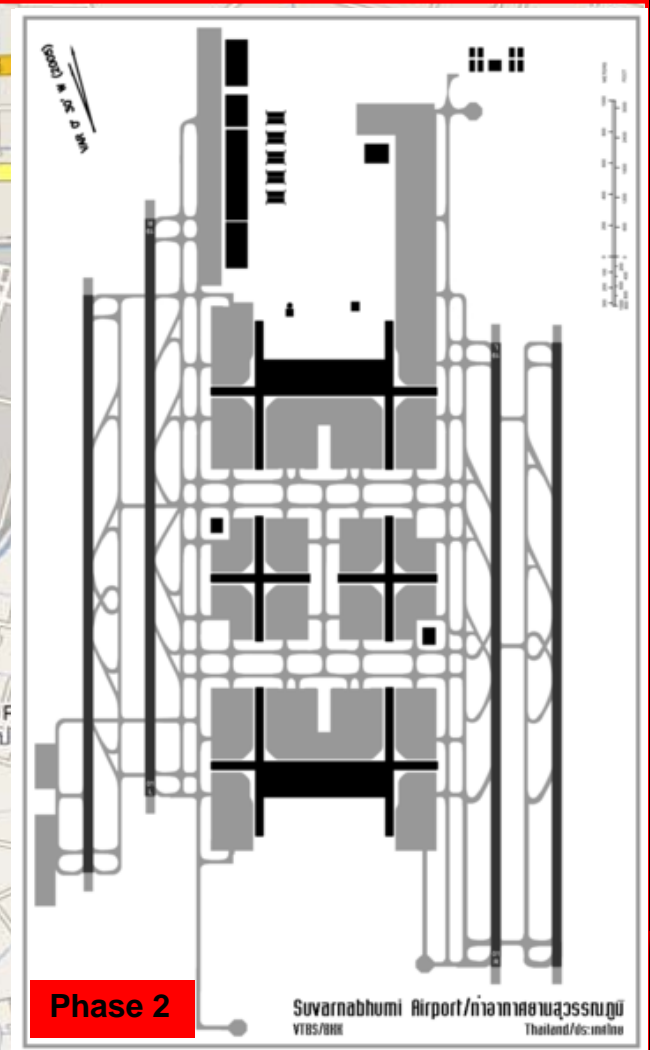
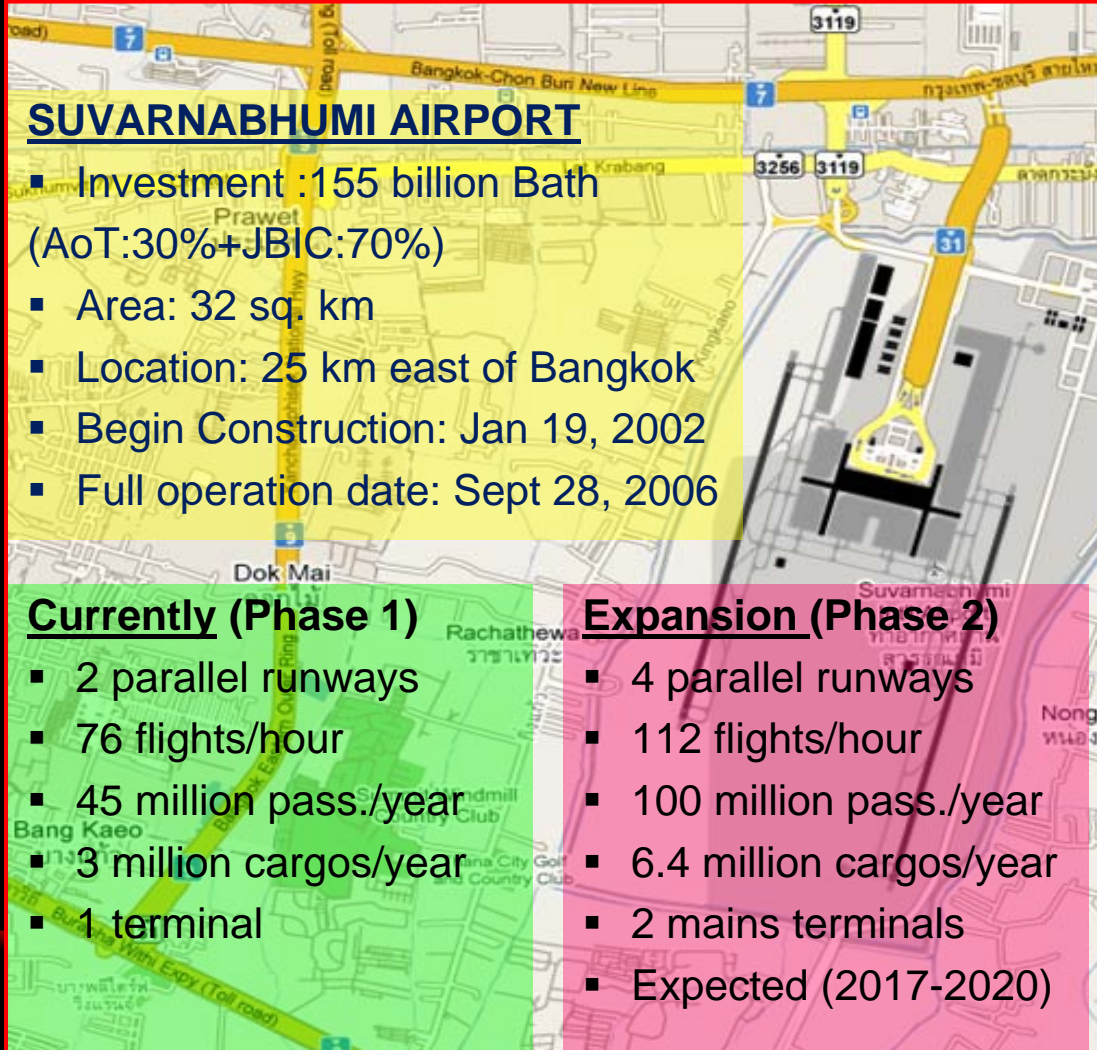
- Investment :155 billion Bath (AoT:30%+JBIC:70%)
- Area: 32 sq. km
- Location: 25 km east of Bangkok
- Begin Construction: Jan 19, 2002
- Full operation date: Sept 28, 2006

## Currently (Phase 1)

- 2 parallel runways
- 76 flights/hour
- 45 million pass./year
- 3 million cargos/year
- 1 terminal

## Expansion (Phase 2)

- 4 parallel runways
- 112 flights/hour
- 100 million pass./year
- 6.4 million cargos/year
- 2 mains terminals
- Expected (2017-2020)





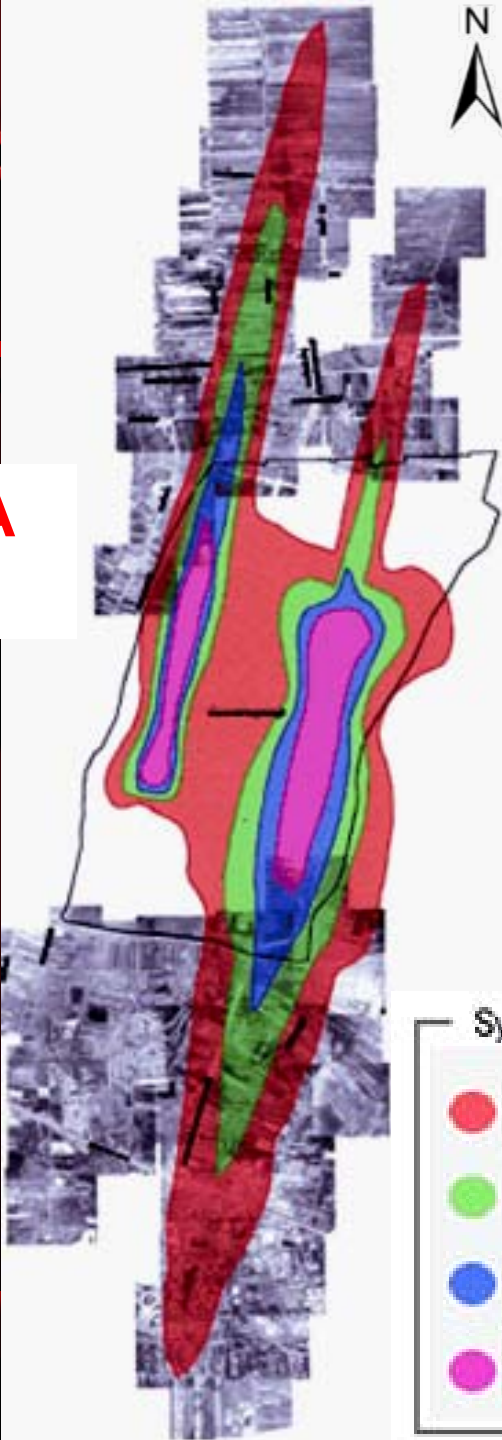
## *Background (cont.)*

- Environmental impacts assessment before the project began
- 13 noise monitoring stations around the airport
- 70 km<sup>2</sup> of land encompassed by noise impact
- More than 3,000 houses, 46 schools & universities, and 76 religious centers affected
- Responsible agencies: AoT and PCD

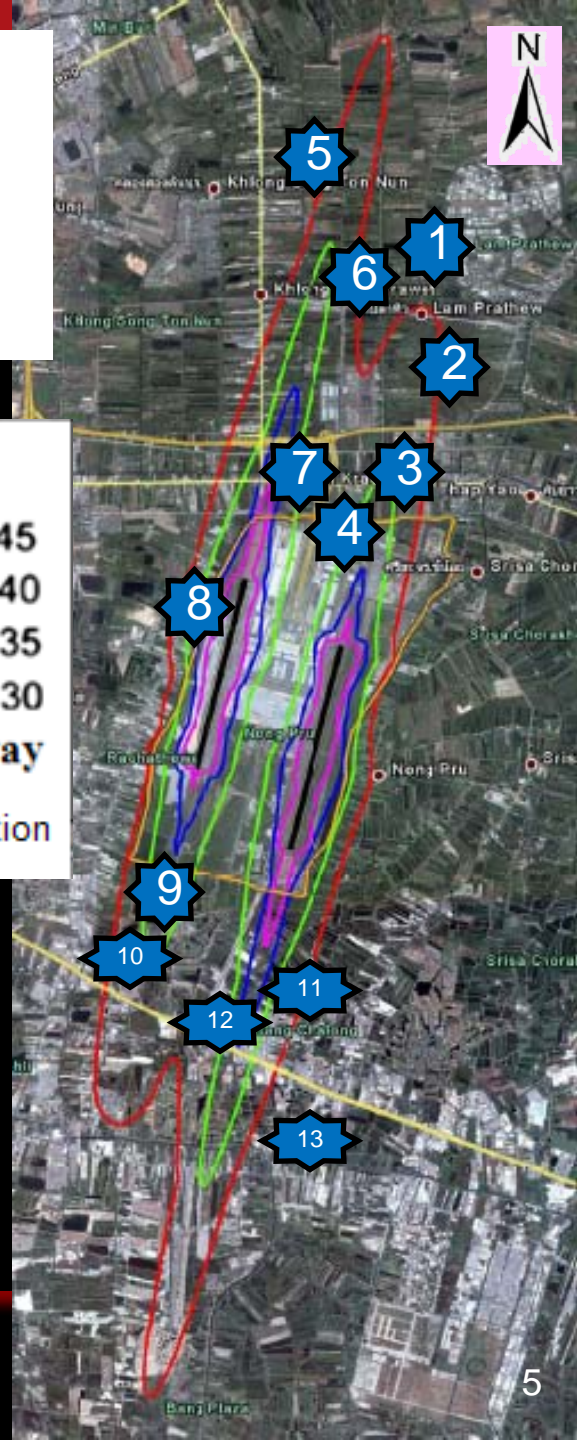
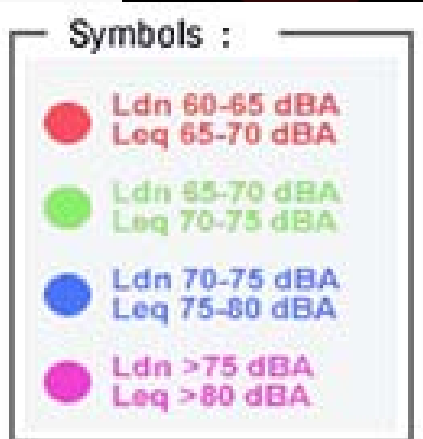
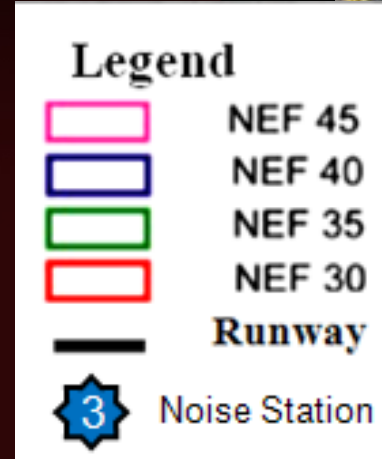




**By EIA  
(2006)**



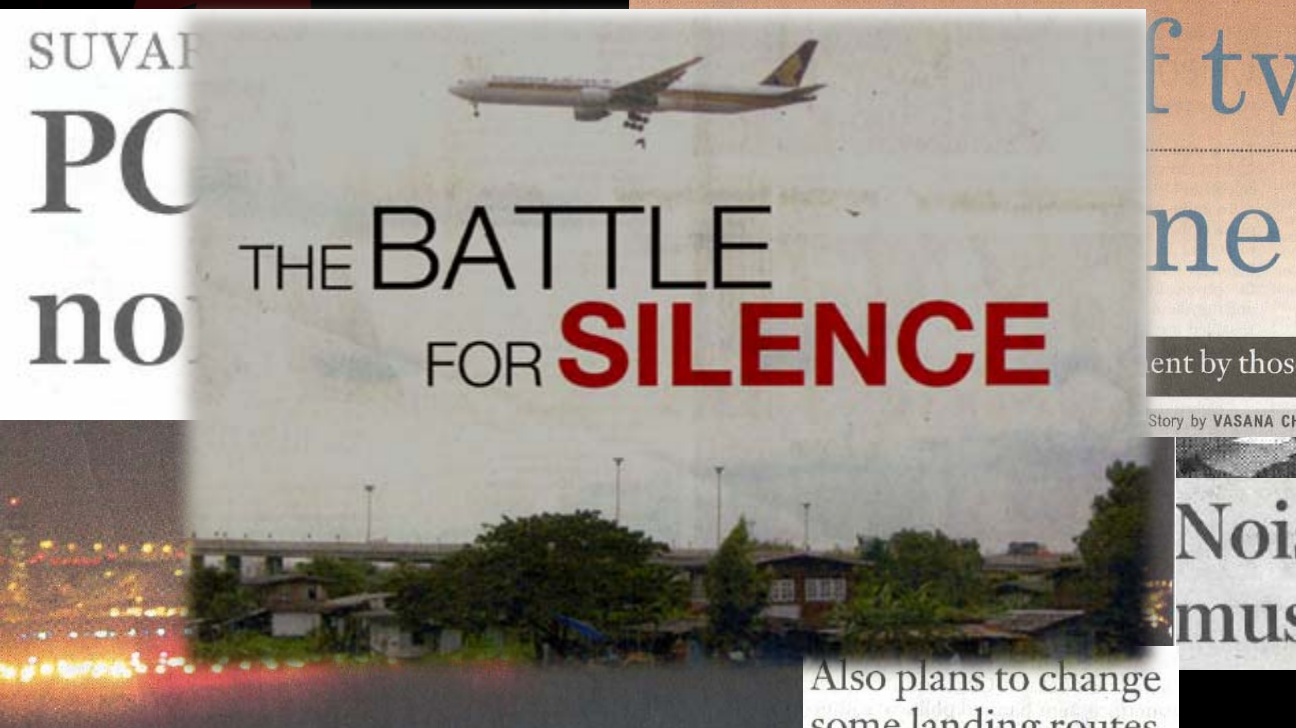
**By AoT and  
approved by  
Thai Cabinet  
(2007)**





# Motivation

- Noise do affects not only the quality of life but also the property values.
- After the opening of Suvarnabhumi airport, complaints about airport noise became a major of argument.

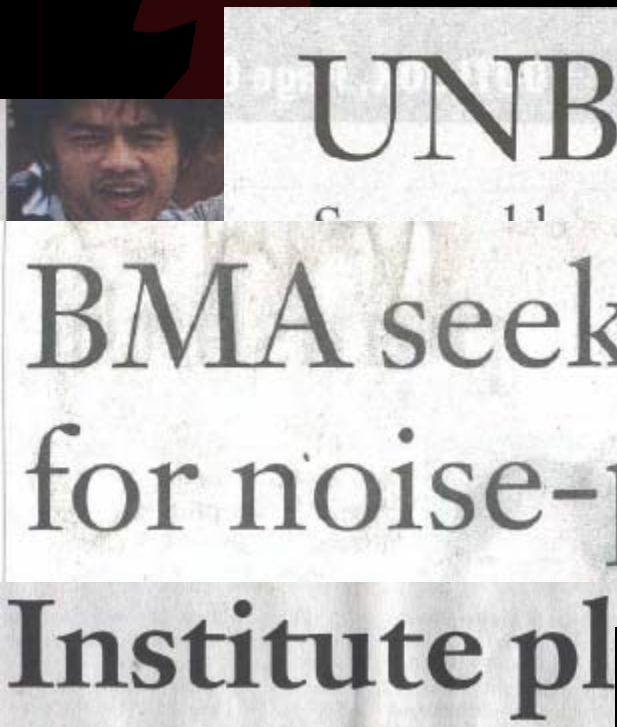


Thanatos Preeprem, a nearby resident of Suvarnabhumi airport, shows off the ear plugs and sleeping pills the Airport of Thailand's medical unit gave him to help him get over the sleepless nights caused by roaring jet engines. — SOMCHAI POOMLARD



## Motivation (cont.)

- In 2006, KMITL located about 3.5 km north the airport, affected by NEF30-35 threatened to sue AoT for 214 million baht for expenditure of sound-proofing their 22 buildings.



“Congratulations to the Suvarnabhumi Airport [causing] many problems that have never been addressed or taken care of”



## *Motivation (cont.)*

- Later that year, AoT agreed to compensate 71 residents affected by noise higher than 70 dB with the amount of 300 million baht for their suffering from noise taking off and landing at the airport.
- In addition, homeowners from 32 communities were unhappy with AoT's tardy responses and in 2007 threatened to release balloons to hinder the air traffic if AoT did not resolve the problem of noise pollution.





## *Motivation (cont.)*

- Compensation scheme by AoT:
  - Only people living in the NEF40 area would be able to sell their properties.
  - For those living under NEF40 area could only be compensated for having their properties repaired.
- However, how much the amount of such compensation is computed remains unclear.

**The objective of this study** is to provide insights into the question of what appropriate amount of compensation for the decline in property value, due to the airport noise, should be.



# *Literature Review*

- To study about the airport noise and property values relationship, 3 methods such as CVM, ANN, and Hedonic have been used.
- Among those, the most application method is Hedonic.
- Several hedonic studies have been found in developed countries such as Canada, the United State, the United Kingdom, and some western European countries.
- However, there is no known hedonic price study of airport noise in the developing countries.
- Especially in Thailand.



# Literature Reviews (cont.)

## Airport Noise Metrics

- Single noise events: Max. sound level ( $L_{\max}$ ) and Sound Exposure Level (SEL)
- Cumulated noise measurements:

Noise Metrics	Abrev.	Country
Community Noise Exposure Level	CNEL	California
Composite Noise Rating System	CNR	Canada
Day Night Average Sound Level	DNL or Ldn	The U.S.
Equivalent Noise Level	LEQ or Leq	The U.K.
Kosten Units	Ku	Netherland
Noise and Number Index	NNI	United Kingdom
Noise Exposure Forecast	NEF	The U.S., Canada, Thailand



## Literature Reviews (cont.)

### Previous airport noise Studies:

- Literature survey by

McMillen (2004) : NDI = 0.64 to 2.4% per dB

Praag and Baarsma (2005): NDI = 0.15 to 3.57% per dB

- Meta-analysis by

Nelson (2004) on 33 estimates of NDI from 23 airports in Canada and the U.S.

Canada: NDI= 0.5 to 0.6% per dB

The U.S.: NDI= 0.8 to 0.9% per dB

Wadud (2009) on 65 studies from 8 countries:

his survey: NDI = 0 to 2.3% per dB

his finding: NDI = 0.81 to 0.85% per dB



## Literature Review (cont.)

### Econometric issues:

- **Heteroscedasticity:**

Occurrence: different variance of error term in each obs.

Problem: wrong S.E. estimate coefficient, invalid  $t$ - and  $F$ -test and OLS is not efficient.

Correction: use GLS or White method

- **Multicollinearity:**

Occurrence: there is correlation between regressors

Problem: imprecise estimate of coefficient, high S.E

Correction: create subsample and use dummy variable



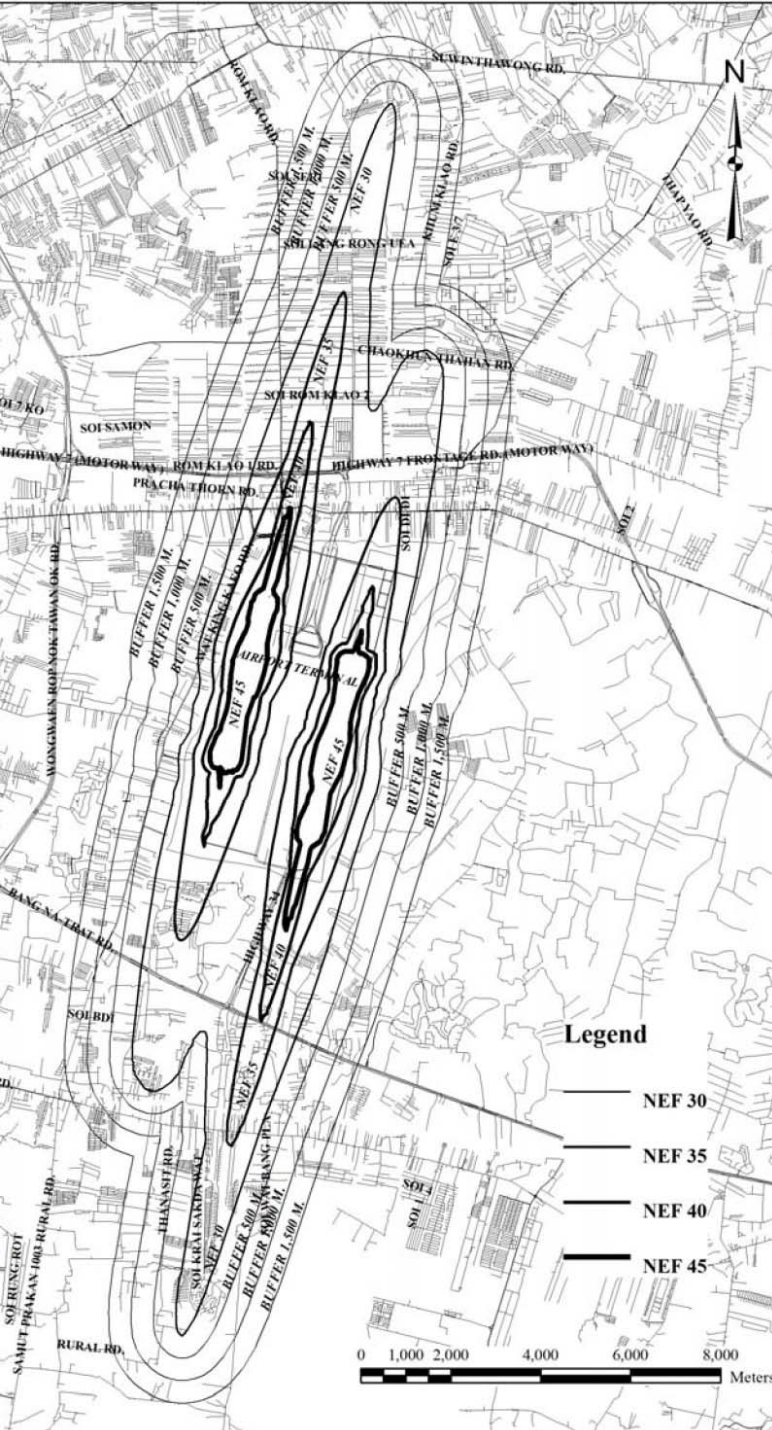
# Empirical Model

## DATA

- 3 sources: 1. AREA: sale price and structural characteristics  
2. ArcGIS: Location characteristics  
3. Noise contour Maps: Noise variables

## Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Price (million B)	4.837	6.053	0.439	65
Floor area (sq. m)	174.486	96.976	18	750
Lot size (sq. wa)	55.432	44.625	16	530
Distance to airport entrance (m)	15634.02	5366.27	2803.09	30730.74



Categorized properties located	# prop. sold
between NEF 40 and 45	0
between NEF 35 and 40	311
between NEF 30 and 35	1,300

Sale Prices (mill. baht)	Type of property			Total
	SFD	DPX	TH	
≤ 5	11,377	3,480	14,663	29,520
5 to 10	6,343	0	274	6,617
10 to 15	754	26	0	780
15 to 20	318	0	0	318
20 to 25	220	0	0	220
> 25	84	0	0	84
<b>Total</b>	<b>19,096</b>	<b>3,506</b>	<b>14,937</b>	<b>37,539</b>



# Empirical Model

## DATA

Number of property transacted 2002-2008

Prop. type & Year	Duplex (DPX)	Single-family detached (SFD)	Town house (TH)	Total
2002	20	677	751	1,448
2003	147	3,227	860	4,234
2004	267	5,259	2,678	8,204
2005	34	3,102	2,532	5,668
2006	421	3,012	2,684	6,117
2007	2,025	1,370	3,292	6,687
2008	592	2,449	2,140	5,181
Total	3,506	19,096	14,937	37,539





## Experiments (cont.)

### Hedonic regression model

- Semi-log functional is selected (facilitate interpretation of results and compare ones to those of previous studies)
- Model structure:

$$\ln P_i = \alpha + \mathbf{X}_i \boldsymbol{\beta} + \sum \gamma_t Y_{ti} + \sum \pi_n \text{NEF}_{ni} + \sum \rho_b D_{bi} + \varepsilon_i$$

where  $P_i$  = the price of property  $i$

$\mathbf{X}_i$  = vector of characteristics of property  $i$  (floor area, lot size, type of property dummies (town house is set as base), and distance to the airport entrance)

$Y_{ti}$  = year dummy variable (1 if sold in year  $t$  and 0 otherwise)

$\text{NEF}_{ni}$  = airport noise dummy (1 if in NEF  $n$  contour zone and 0 otherwise)

$D_{bi}$  = brand dummy variable (1 if developer  $b$  and 0 otherwise)

and  $\varepsilon_i$  = disturbance term



# Results

	SS	df	MS	F( 24, 359) =	384
<b>Model</b>	<b>228.3361</b>	<b>24</b>	<b>9.5140</b>	<b>Prob &gt; F =</b>	<b>0.0000</b>
Residual	32.37896	359	0.0902	R-squared =	0.8758
Total	260.715	383	0.6807	Adj R-squared =	<b>0.8675</b>

Dependent variable = ln(Price)

	Coef.	Std.	t	Prob.	Lower	Upper
Floor area (sq.m)	0.005630	0.00022	25.81	0.0000	0.00519	0.00607
Lot size (sq. wa)	0.001258	0.00052	2.42	0.016	0.00021	0.00230
Single family dummy	0.534452	0.041	12.81	0.0000	0.452	0.617
Duplex dummy	0.318741	0.054887	5.81	0.0000	0.210801	0.426681
Airport distance (m)	-2.1E-05	2.2E-06	-9.51	0.0000	-2.5E-05	-1.7E-05
Year 03	0.163785	0.086157	1.90	0.060	-0.00561	0.33318
Year 04	0.121235	0.086157	1.41	0.160	-0.04810	0.290652
Year 05	0.144315	0.087899	1.64	0.102	-0.02855	0.317178
Year 06	0.239499	0.090175	2.66	0.008	0.05932	0.41967
Year 07	0.152828	0.090175	1.70	0.090	-0.02855	0.331141
Year 08	0.338075	0.090175	3.76	0.0000	0.161034	0.515116
NEF 30	-0.101610	0.13026	-0.78	0.437	-0.36187	0.15865
NEF 35	-0.348630	0.140	-2.49	0.012	-0.62866	-0.06860
Constant	-0.047760	0.104	-0.46	0.645	-0.25582	0.16030

1 m<sup>2</sup> increase in floor area leads to 0.56% (27,048 baht) increase in property price

SFD & DPX, sell for more than town house by 53.4 and 31.8 percent

About 2% decrease in price if property located 1 km further from the airport entrance

For property located in NEF30, noise discount implies for 10%, although effect is insignificant.

34.8% discount in price if property located in NEF 35 noise zone, compare with a similar property located elsewhere



## Conclusion

- We examine the airport noise impact on property prices using hedonic price function approach with new sale prices of properties located in the vicinity of Suvarnabhumi airport.
- The results show substantial impact of airport noise on property values.
- The noise discount per dB is  $(34.8\% - 10.1\%) / 5 = 4.9\%$
- NDI = 4.9% per dB is high comparing to previous studies
- The results of this study, however, can help the AoT to set up an appropriate compensation scheme for those affected parties.



## *Future Research*

This study can be improved by several ways:

- Include more variables such as noise buffer zone, distances to the nearest transportation facilities, etc.
- Incorporating spatial effects: test and correction for spatial dependence and heteroscedasticity.
- Include resold property prices

Thanks for Your Attentions!

