附錄C　論文發表之照片及簡報內容

圖 C-1　論文作者於簡報前合影

圖 C-2　論文簡報會場

交通部運輸研究所
Institute of Transportation MOTC

Applying GIS to Assess The Influence of Public Transportation Operating Plans on The Accessibility

Su, Jau-Ming ； Tsai, Chin-Tung

Chang, Ching ； Wang, Jin-Yuan

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2 Outline

- Introduction
- Literature Review
- System Architecture
- Construction of Indicators
- Case study
- Conclusions

3 Introduction(1/4) :Before

- The Ministry of Transportation and Communication (MOTC) in Taiwan has promoted the Development of Public Transport by investing Substantial Amount of Funding Annually.
- The MOTC has Assisted Local Government in Upgrading Public Transportation Systems to Achieve Seamless Transportation Regarding the Aspects of Space, Time, Information and Service.

4 Introduction(2/4) :Before

- Local governments struggle to obtain funding from the MOTC to acquire vehicles and establish new routes.
- Whether The Current Bus Service Meet the Demand of Citizens.
- Insufficient Assessment Information to Examine Application Cases of Bus companies.
- Measure Bus Service Performance Roughly or Effortlessly

5 Introduction(3/4): We Want

- To Know Where The Spatial Gap Is.
- To Know When The Temporal Gap Is.
- To Know Whether New Routes Increase the accessibility and service coverage of specific regions.
- To Apply the Spatial Analysis Functions of the Geographic Information Systems (GIS) and Integrate APTS Database to Establish a New System to Get Solutions.

6 Introduction (4/4): Case Study

- Analyze the Effects of New Bus Routes Established in Hsinchu City from 2009 to 2012.
- Use Systematic Analysis Methods to Assess the Effects of Changes of Bus operating plans.

7 Literature Review (1/4)

- Accessibility is commonly used to measure whether the service quality of public transport in an area meets the public needs.
- This category involves measuring the range of service covered by a public transportation system.
- Previous studies have set the range of services for bus stops and stations to 400 meters (0.25 mile) and for rapid transit system stops and stations to 800 meters (0.5 mile).

8 Literature Review (2/4)

Accessibility Indicators Based on the Range of Service for Stations and Stops

- Murray et al. (1998) used GIS to analyze the accessibility of public transportation in Queensland, Australia. Their study used traffic zones as the basic unit for accessibility analysis. That is, a traffic zone was accessible if located within a specific distance from a public transportation station.
- Murray (2001) set 400 meters as the range of service for public transportation stations in Brisbane, Australia. Their study also employed the Location Set Covering Problem (LSCP) to integrate bus stop operations.

9 Literature Review (3/4)

- Biba et al. (2010) used population characteristics from an analysis of street blocks that could be served by walking within a range of 400 meters from public transportation stops to measure route accessibility. The population characteristics included the population value, family characteristics, and family structure. The result indicated that their analysis method could be used to understand the population characteristics of people capable of being served by public transportation routes.
- Graham (2010) used census data and weekly vehicle numbers of buses, trams, and trains stations to determine public transportation supply and demand indicators. The calculation of public transportation supply involved collecting stopping point data from three primary forms of public transportation: buses, trams, and trains.

10 Literature Review (4/4)

Accessibility Indicators Based on Important Landmarks

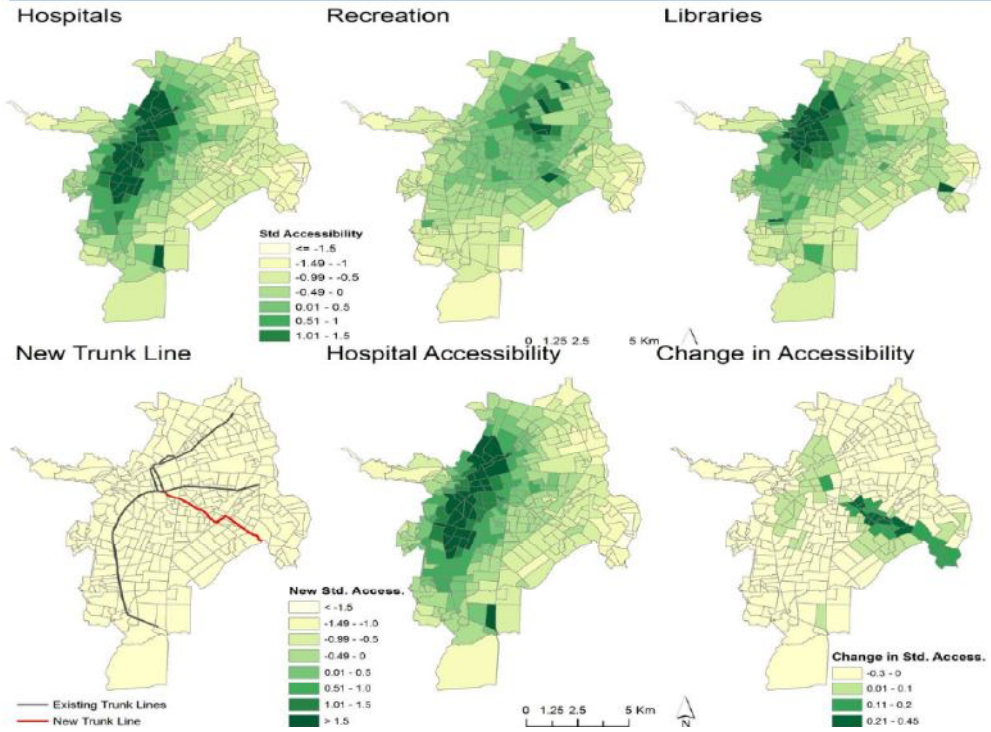
$$A_i = \sum_j O_j d_{ij}^{-b}$$

Where A_i is accessibility of geographic unit i. O_j represents attraction of opportunity j in the space in the study area. d_{ij}^{-b} is the impedance between opportunity and target (i) of the study, i.e. a place, a group of people, or an individual. The impedance is usually represented by spatial distance or travel time.

$$A_i = \sum_j (O_j D_{ij} S_{ij})$$

This study included additional service factor, i.e. the concept of transit shifts, to formulate a new accessibility indicator

11 Accessibility Indicators Based on Important Landmarks

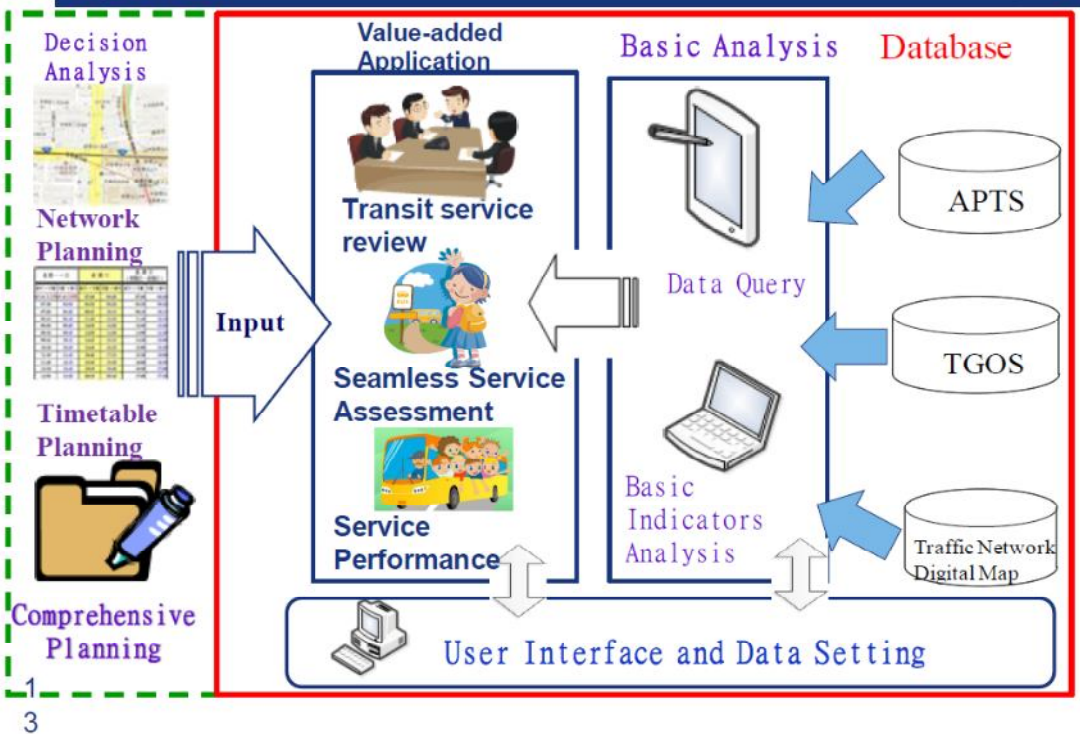


12 TSAS

- Transit Service Assessment System with APTS Database
- A Powerful Diagnostic and Prescription System
- Nineteen Assessment Indicators for Transit Service Seamless Assessment
- Fourteen Assessment Indicators for Application Cases Review

13

System Architecture and Functional Design



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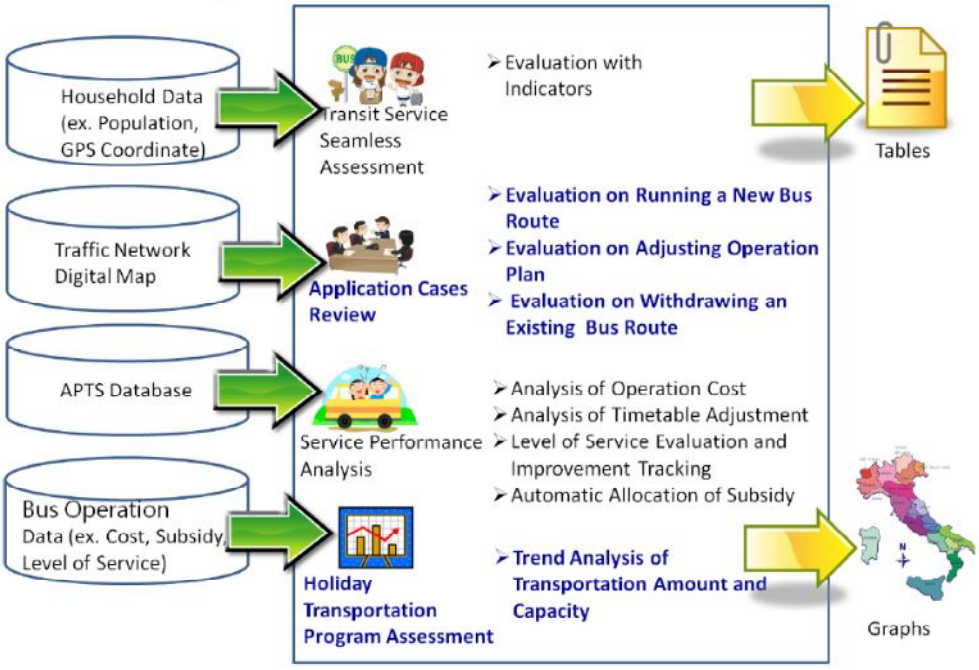
The System Architecture and Functions of TSAS



15 Construction of Indicators

The service population Indicator of Route A (SP_A)

$$SP_A = \sum_{j=1}^{J} HC_{Aj} \times POP_j = \sum_{j=1}^{J} \frac{\sum_{h=1}^{H} H_{jh} \times f_{Ajh}}{H_j} \times POP_j$$

The service population indicator of route *A* is the product of the household coverage (HC_{Aj}) of the covered administrative region *j* and those regions' number of population (POP_j). The f_{Ajh} is one , when the household *h* is covered by route *A*.

16 Construction of Indicators

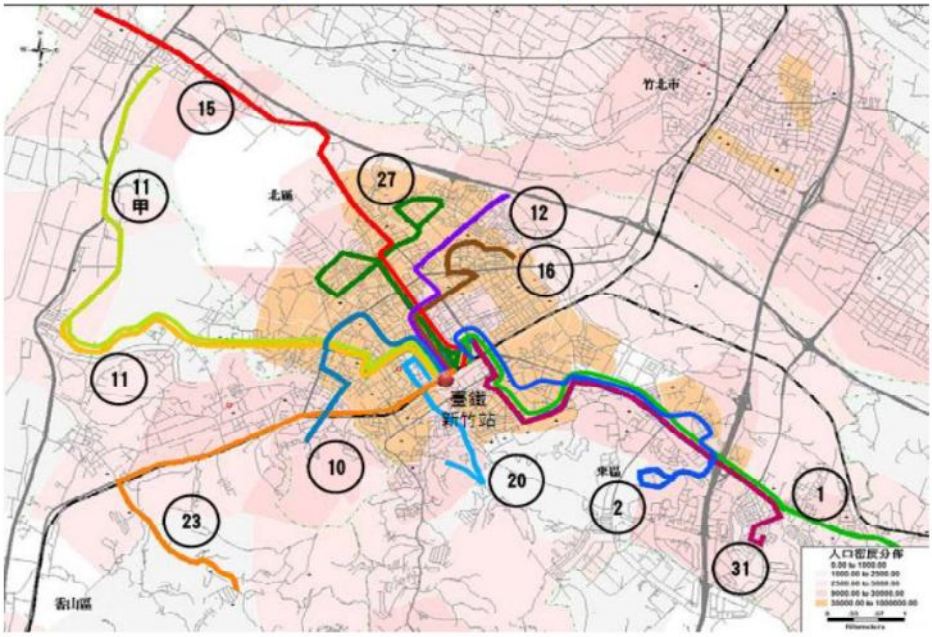
The time period spatial service Coverage Indicator(S^t_i)

$$S_i^t = \frac{\sum_{j=1}^{n} S_{ij}^t}{H_i} \times 100\%$$

S^t_i is the periodically spatial service coverage at time period *t* in region or district *i*.
S^t_{ij} is the quantity of house numbers covered in the service of stop j at time period *t* in district *i*.
H_i is the quantity of house numbers in district i

17 CASE STUDY

Bus Route Map in Hsinchu City



18 Changes in service coverage after new routes were established in Hsinchu City

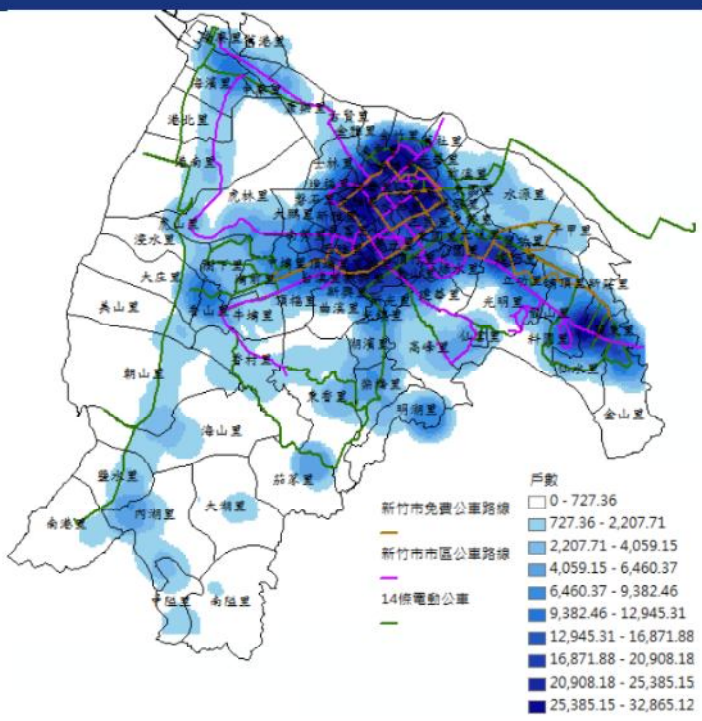
Year	Service Coverage (%)		Public Transport Usage (%)
	Doorplates	Roads	
2009 (12 City Buses)	79	51	5.8
2010 (4 Free Buses Added)	84	57	6.1
2011 (2 Free Buses Added)	85	64	6.4
2012 (14 Free Buses Added)	99	89	NA

19 The Effects of the New Free Bus Routes in Hsinchu City

20 The periodically Service Coverage for the Bus in Hsinchu City

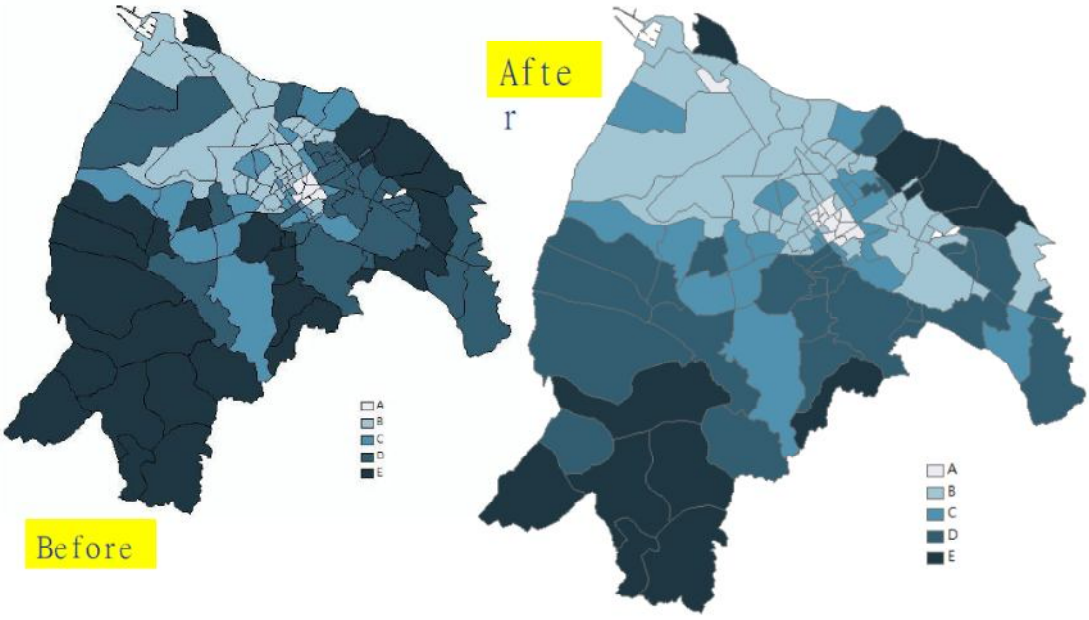
Time Period	East		North		Hsiang-Shan	
	City bus(%)	Free bus(%)	City bus(%)	Free bus(%)	City bus(%)	Free bus(%)
07:00~07:59	74.79	28.94	95.45	42.66	42.58	5.14
08:00~08:59	32.96	28.15	95.82	41.78	44.43	5.14
09:00~09:59	71.85	32.12	97.76	49.35	44.42	24.07
10:00~10:59	74.59	29.25	95.84	42.03	43.97	5.14
11:00~11:59	21.61	29.08	89.84	40.47	44.42	5.14
12:00~12:59	30.64	28.24	95.80	49.96	44.17	17.95
13:00~13:59	21.88	17.80	77.85	31.39	43.95	19.61
14:00~14:59	73.83	28.28	93.50	26.23	42.57	12.55
15:00~15:59	68.35	24.26	82.14	38.50	42.83	21.41
16:00~16:59	74.71	31.70	97.77	33.88	44.34	12.55
17:00~17:59	76.17	26.61	93.57	36.54	44.45	19.61
18:00~18:59	31.67	19.08	95.82	44.37	43.98	23.94
19:00~19:59	34.71	34.77	72.39	5.58	43.98	0.00
20:00~20:59	5.57	0.00	72.39	0.00	12.27	0.00

21 Bus Routes & Population Density in Hsinchu City

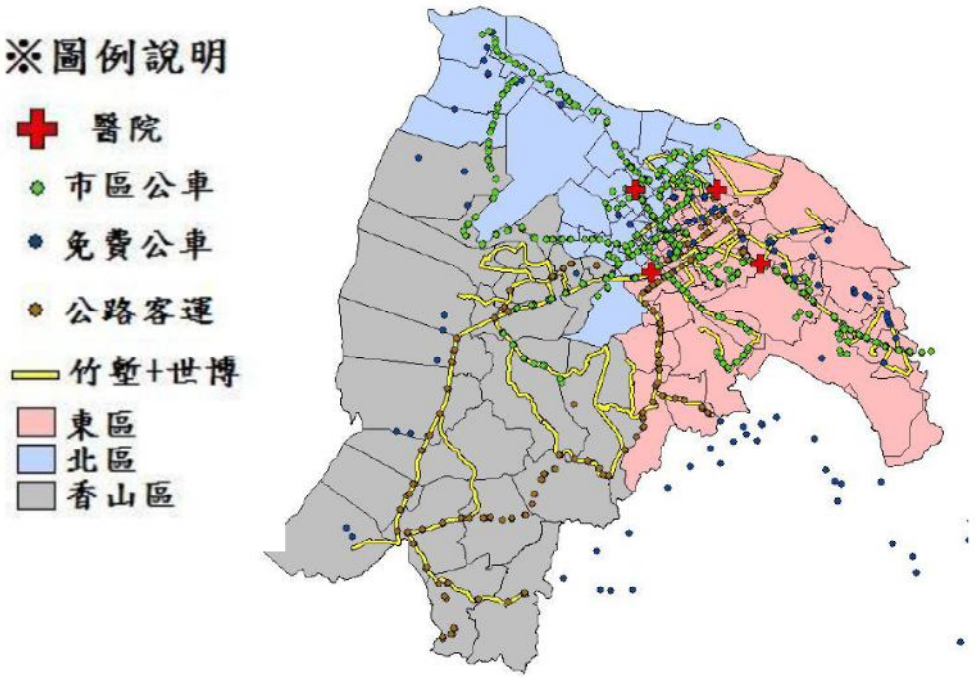


22 The Effects of the New Free Bus Routes in Hsinchu City

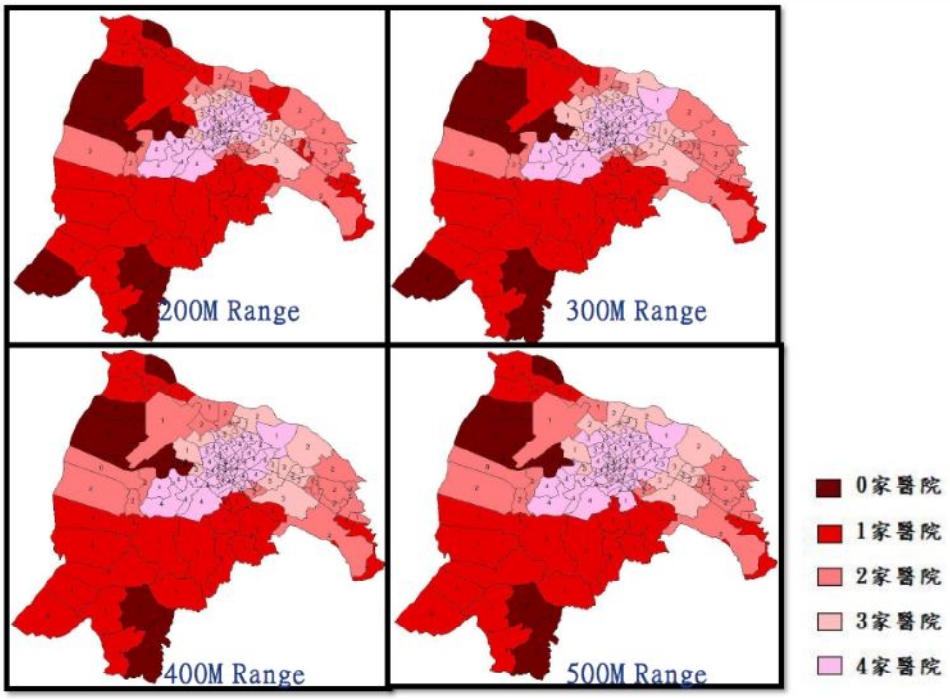
❖What is the New Free Bus Service Quality?



23 The Accessibility to Hospitals for New Free Bus Routes in Hsinchu



24 Accessibility to Hospitals in Different Ranges



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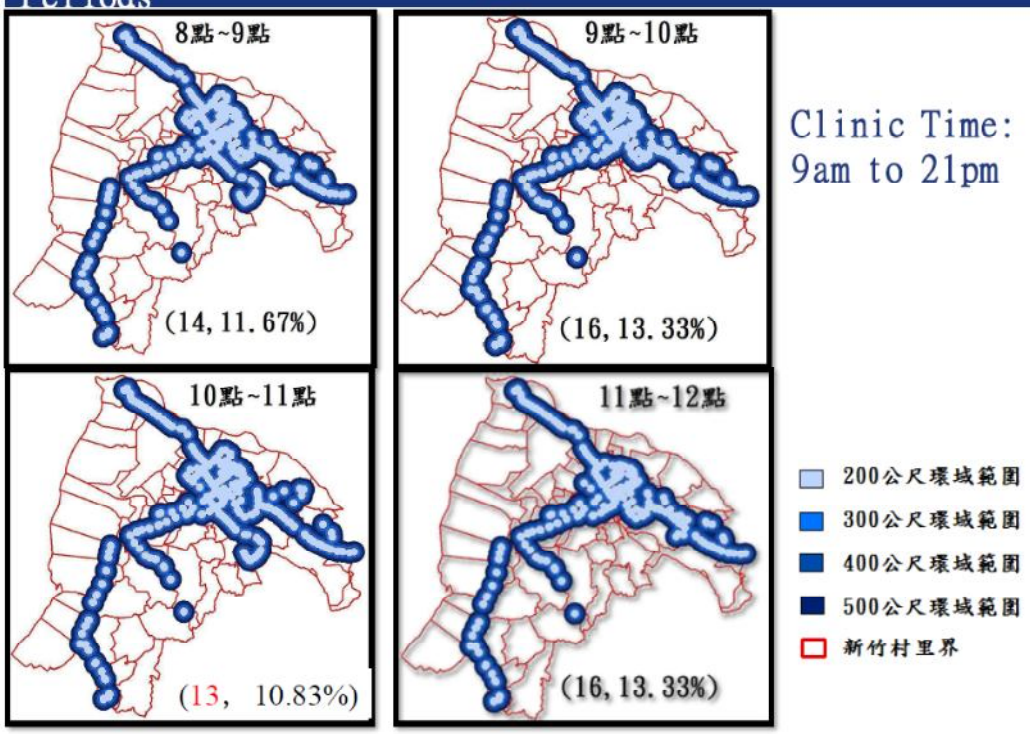
Accessibility to Hospitals in Different Time Periods



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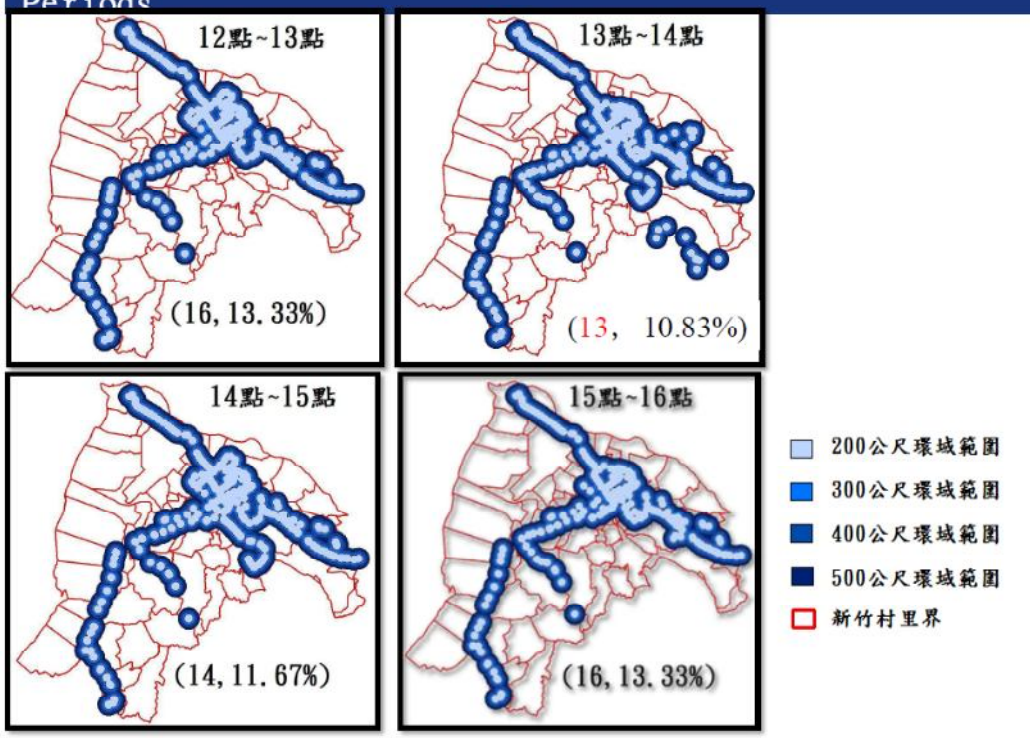
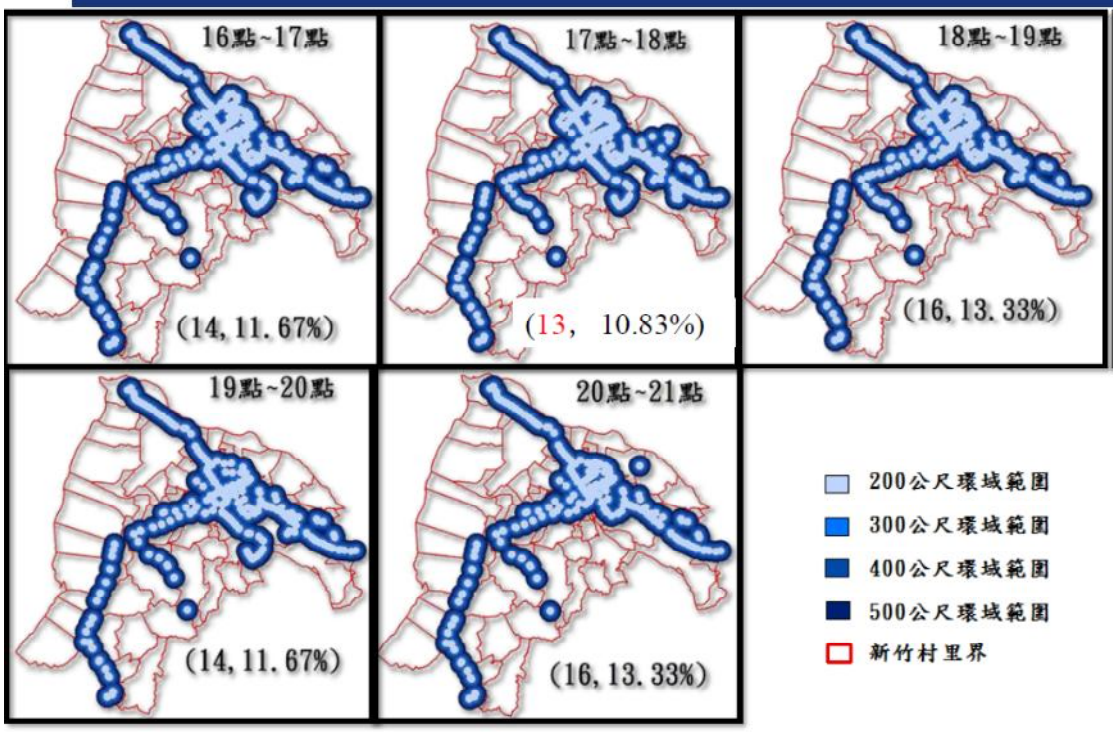
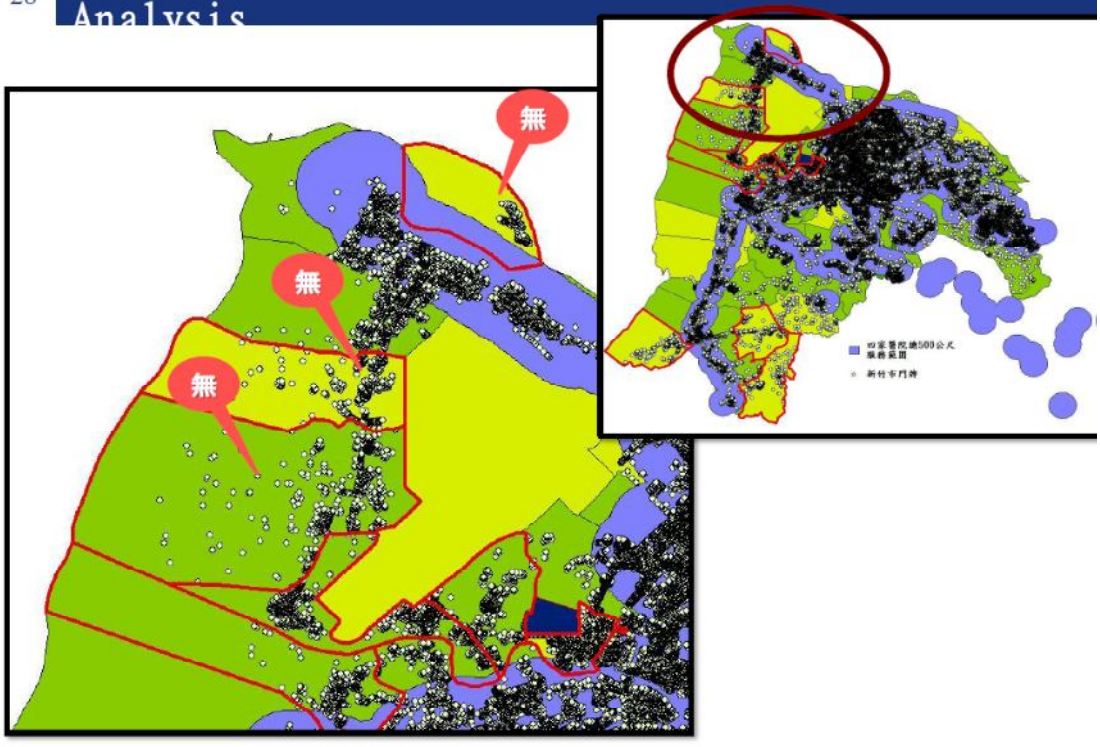
Accessibility to Hospitals in Different Time Periods



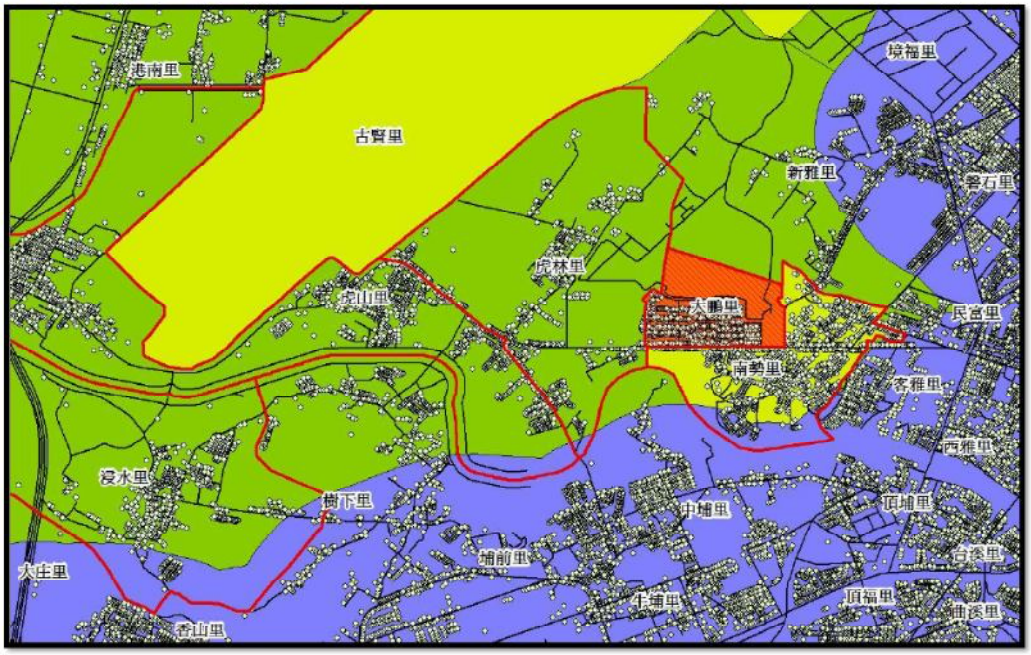
27 Accessibility to Hospitals in Different Time Periods



28 Inaccessible to Hospitals Household Analysis



29 Inaccessible to Hospitals Household Analysis



30 Conclusions (1/2)

- Transit Service Assessment System with APTS Database (TSAS) was successfully Developed.
- TSAS includes APTS, GIS, Operation Data, and Population Distribution Data.

31 Conclusions (2/2)

- TSAS Helps Local Government Authorities Find the Gap of Transit Service and Assess the Impact of Adjusting Operation Plans Based on Multi Assessment Indicators.
- After Increasing Six Free Bus Routes yearly, the service household accessibility has reached to 99% in Hsinchu City.

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- Exerting the indicators, we can measure the effect of the investing funds that has on the mass transportation seamless environment.
- This can also be the reference for evaluating seamless transportation in different cities.

33 Acknowledgment

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Thank you.