

## Hong Kong

“In Hong Kong, public transportation accounted for as many as 90% of all person trips, and the railways accounted for 37% of average daily public transportation trips in 2006 ([Transport Department, 2009](#))”.

### Statistically Significant factors for improvement of ridership

- Garage area increases ridership
- Commercial floor area increases ridership
- Mixed use floor area increases ridership
- Interchange stations attract more passengers
- Most variables that have a statistically significant impact on ridership are related to the metro station itself as opposed to the train
- Age of metro station positively associated with ridership because in Hong Kong old areas of the city are vibrant cultural centers
- Car ownership in the “catchment area” is positively correlated with ridership
- Population density in the “catchment area” is positively correlated with ridership
- Hong kong study shows that high employment opportunity near a railway station is not enough to improve ridership, mixed use land is a more effective metric
- Number of bus stops near the railway station significantly impacts ridership

### Notes

- High garage area/ parking areas in metro stations have a statistically significant effect on ridership at that given metro station.
- “buffer/catchment area” - 500 meter circular area from center of station
- Concentration of Inter-modal transportation options near transit center significantly increases ridership despite competitive nature of other forms of transportation
  - Bus stations
  - Car ownership/household
- Pages 206-211

### Citation

Loo, B. P., Chen, C., & Chan, E. T. (2010). Rail-based transit-oriented development: Lessons from New York City and Hong Kong. *Landscape and Urban Planning*, 97(3), 202-212. doi:10.1016/j.landurbplan.2010.06.002

### Octopus Card

- Rechargeable contactless cash card that works for metro, ferry, bus, trams and some convenience stores

- Allows for more convenient ridership, no need for exact change, quick payment
- Offers some incentives for ridership
  - Octopus card swipe cheaper than a standard ticket
  - Promotions for Airport Express and Cityflyer Routes Passengers
- 70% of Hong Kong's population are Octopus card holders
- Can only add value at some stores and transit stations, would be better if there were a supported auto recharge feature

#### Citation

Chau, P. Y., & Poon, S. (2003). Octopus: An E-Cash Payment System Success Story. *Communications of the ACM*, 46(9), 129-133. doi:10.1145/903893.903927

### Public Policy Affects Transportation

- Hong Kong legislation in 1999 to increase railway usage by 50% by 2016
  - Combined with legislation enforcing freedom of choice in public transit
  - Allowed for other forms of public transit (bus, tram, etc.) to develop in tandem
  - Led to oversupply of public transit, mainly too many bus companies
  - Buses would increase number of stops and number of buses running a route to remain competitive with other bus companies, increased congestion especially on popular routes
  - Hong Kong Government intervened in early 2000's forcing bus companies to rationalize their stops and number of busses on a route, increased average speed on roadways from 20 kph to 22 kph
  - Reduction in bus traffic led to a more effective system where railways and buses had a more balanced ridership
- Long term consistent transport policies is important

#### Citation

Tang, S., & Lo, H. K. (2008). The impact of public transport policy on the viability and sustainability of mass railway transit – The Hong Kong experience. *Transportation Research Part A: Policy and Practice*, 42(4), 563-576. doi:10.1016/j.tra.2008.01.022

### Transportation Design Team Success

- Design teams office
  - Opportunities for informal contact with colleagues
  - Clarity of team functionality (role)

- “More frequent communications between relevant parties” (1191)
- “Development of harmonious relationships” (1191)
- “Effective problem solving” (1191)
- “quick/ timely decisions” (1191)
- “Enhanced creativity/ innovation”(1191)
- “Partnering”
  - “Building cooperation and getting improvements for the benefit of all parties within a project team” (1192)
  - “M-T-R” model
    - M - Mutual
      - visions/objectives
      - Goals
      - benefits
    - T - Trusted
      - Collaboration
      - relationship
    - R - Responsible for
      - Working with complementary competencies
      - Effective communication
      - Creating value for project success
- Design Stage
  - Feasibility study
    - Patronage and revenue forecasts
    - Cost estimates/ economic benefits
    - Produce preliminary recommendation
  - Preliminary design
    - Find land/ engage in statutorial process
    - High level design details look for innovative techniques
    - More detailed cost estimate
  - Detailed design
    - Complete design of all systems
    - Obtain all necessary governmental consents
    - Identify need for contracts and award them

Citation

Ping, C. S., Keung, C. N., & Ramanathan, M. (2011). Integrated Team Design Process – Successful Stories of Hong Kong MTR Corporation Projects. *Procedia Engineering*, 14, 1190-1196. doi:10.1016/j.proeng.2011.07.149

## Seoul, South Korea

Seoul Ranking-

Overall- 64.4%

People- 69.6%

- Fatalities- 83%
- Access to transportation services- 26.8%
- Modal split of trips taken- 100%
- Rider connectivity- 100%
- Upkeep of the transport system- 95.6%
- Wheelchair access- 66.6%
- Uptake of active commuting- 45.8%
- Transport application and digital capabilities- 63.2%
- Airport passengers- 64.4%
- Hours of metro accessibility- 20%

Planet- 72.2%

- Greenhouse gas emissions- 90.8%
- Provision of green space- 56%
- Congestion and delays- 62.7%
- Bicycle infrastructure- 65.4%
- Air pollution- 68.3%
- Efforts to lower transport emissions- 60%
- Electric vehicle incentives- 100%

Profit- 51.3%

- Commuting travel time- 67.3%
- Economic opportunity- 70.3%
- Public finance- 36.5%
- Efficiency of road networks- 0%
- Affordability of public transport- 66.7%
- Utilization of the transport system- 46.4%

*Public Transportation Service Evaluations Utilizing Seoul Transportation Card Data - Ji-Young Song et al*

- In 2007, an integrated payment system was introduced in Seoul's system accompanied with smart cards
- Smart cards store and individual's transfer data
  - Allows for collection of observational complete enumeration data on travellers and makes it possible to overcome the limitation to a single line
- Used data on the passengers who used 482 stations on 12 lines of metropolitan subways and over 15,000 stops on 405 bus lines for an entire day
- Integrated proportion data system allows for a maximum of 4 transfers
- 99% of total trips consisted of 0-2 transfers
- Need to ask passengers about opinion on transfer system functionality, transfer convenience, mobility

#### Public Transport Reforms in Seoul: Innovations Motivated by Funding Crisis - John Pucher et al

- July 1st 2004, Seoul Metropolitan government introduced a wide range of reforms to its public transport system
  - Reorganized bus services installed Bus Rapid Transit (BRT)
  - Improved coordination of bus and metro services
  - Fully integrated fare structure and ticketing system between routes and modes
- This article describes the reforms and assess their impacts on **safety, speed, cost, passenger levels, and overall customer satisfaction**
- Reforms increased public control of bus services and reorganized the entire bus systems into 4 divisions

#### Impacts of Population and Economic Growth on Travel Demand

- Greater seoul metro area quadrupled in population between 1960 and 2002
- 40 fold increase in real per-capita income
- Made private cars more affordable
  - Tiny percentage of car ownerships grew by 2003
- Increase private cars has caused severe traffic congestion , especially on radial arterial highways
- Average roadway speeds are only 20km per hour and 17km in the two central business districts
- Increased car use = high levels of air pollution, noise, and traffic accidents
- Congested roads slow down bus service quality

#### Reliance on Metro System to Solve Transport Problems

- Until 1974, seoul was almost entirely dependent on bus services
- Sharply rising roadway congestion, reduced bus speeds, higher passenger volumes, and longer trip distances increased the necessity for an urban rail system
- 1974- first rail system 8km

- 2004- 487 km rail system
  - 13 lines, 389 stations
- One of the largest in the world and carries 8.4 million passengers per day (twice the volume of NYC subways and London)
- Debt: \$6 billion, 80% of the city's total debt
- Passenger fares only cover 75 percent of operating costs, remaining 25 percent subsidized through various program by the city government

#### Bus Service in Seoul Before 2004 Reforms

- Suffered from high efficient, uncoordinated, and dangerous operating practices
- No coordination among the different bus companies, many routes were highly circuitous, overlapping, and not integrated
- Disregarded rider safety and comfort
- Old, poorly maintained, and did not meet international standards
- Service was dangerous, slow, uncomfortable, and unreliable
- To protect buses from worsening roadway congestion, the first curbside bus lanes were installed in 1984 and expanded to 213 km by 2003
- Network of reserved bus lanes helped speed up bus travel somewhat but did not attract more passengers
  - More changes needed

#### Bus Service in Seoul After 2004 Reforms

- Entire redesign of the bus route network to better structure and integrate more than 400 different bus routes
- All bus services are now grouped into 4 types with **color coordination** to help passengers distinguish between them
  - Blue = long distance connecting outlying suburbs
  - Red = long distance express
  - Green = local services
  - Yellow= within city center
- New Bus Management System (BMS)
  - GPS located in every bus now permits for a central bus control center
  - **More dependable, providing real-time information for passengers**
- Dedicated bus lanes was increased to 294 km
  - **Less congestion, more efficient**
- High quality bus stops
  - **Comfort**
- Buses running on compressed natural gas - **less pollution**

- Level boarding platforms at BRT stops, getting on and off express buses will be **easier, faster, and safer**
- To further facilitate short and easy transfers between the bus and metro, 22 major transfer centers were constructed that offered passengers **convenience, sheltered bus stations and real time information**
- Fares are based on distance traveled, with free transfers between bus lines and bus + metro
- Smart card- T-money
  - Can be used for all bus and rail services
  - **Increase ease of payment**
- Monthly commutation tickets that **offer discounts** to regular travelers

#### Impacts of the Reforms

- Transit signal priority
  - Which will facilitate bus turns and **reduce wait times** for buses crossing intersections
- Fully computerized system coordinates roadway traffic as well as public transit vehicles, thus permitting optimization of traffic signals to speed up buses
- **Decline in bus related accidents and personal injuries**
- Daily bus ridership increased by 406,00 passengers per day between sept 2003 to sept 2004 +7%
  - Increased 14% between march 2003 to march 2004
- T-money fare collection permits far more up-to-date monitoring of passenger levels

#### Light Rail Transit Plans

- Build several new LRT lines
- Costs \$107 million per km for a rail line
  - 10 times as expensive of bus rail

#### Conclusion

- Increased **public control** over routes, schedules, and other aspects of service

#### *An analysis of Metro ridership at the station-to-station level in Seoul - Jinkyung Choi et al*

- Station to station analysis made it possible to distinguish the effect of origin factors on metro ridership from that of destination factors
- Three principles of TOD, **Density, Diversity, and Design** which were suggested by Cervero and Kockelman are known to increase transit ridership
- **Importance of connectivity of transit lines** in addition to the TOD principles

- When assessing the transit system at the level of the individual traveler
  - Built environment, travel impedance, individual characteristics, and even psychometric propensities
- Understanding the placement of the tram station
  - Congestion may depend on a time of day
    - Ex: to an office area, congestion would be worst on public transit during morning and evening peak hours
  - **Walkability from each tram station** to popular destinations
- Take into account competing modes in the same form
- Two city center in the seoul metropolitan area had significant impact on station to station riderships when these were destination stations
- **Providing good feeder bus services** in both origin and destination stations at all time periods considerably enhanced metro ridership

#### *Seoul Public Transportation - Seoul Metropolitan Government*

- “ It is not regarded as one of most enviable public transport services in the world in terms of **convenience, safety, punctuality, and economic efficiency**
- Four billion citizens use the public transportation each year
- Vision for Seoul
  - **People- centered transportation**
    - Encourage walking and cycling
    - Reduce traffic fatalities
    - Ensure the vulnerable populations access to public transportation
  - **Environmentally conscious transportation**
    - Minimize unnecessary travel demand
    - Create an eco-friendly, efficient transport environment
    - Promotion of advanced transportation culture of citizens
  - **Sharing of transport resources**
    - Rail centered mass transit
    - Faster public transportation
    - Create an environment conducive to sharing transport resource
- Transportation breakdown
  - 28% bus
  - 37.1% subway
  - 23.5% passenger car
  - 7% taxi
- Benefits of reform



- Increase in bus ridership
- Improvements in the speed of buses and other vehicles bc of exclusive median bus lanes
- Lower cost burden for transportation services
- Better air quality
- Lessened fare burdens on the less transport fare burdened for the citizens improved air quality
- Greater aesthetic value of the city
- A new bus number system that clearly indicates where buses originate from and end their trips
  - **Clarity**
- New bus route reform improved **mobility and accessibility**
- Median bus stops
  - Reinforced passengers' **convenience and safety** with comfortable shelter functions and cutting-edge bus information systems
  - 329 median lane bus stops
- Median bus lanes have improved bus speeds on average by 30%

#### Introduction of a quasi-public bus operation system

- Reform directions
  - Seoul manages the bus routes and the revenues while the private companies operate the buses
- Reasons for introducing the new system
  - External factors: increase in car ownership (lead to congestion), completion of subway lines, expansion of bus system
  - Internal factors: financial difficulties, dissatisfaction
  - Policy factors
- Bus Transfer Center - Located at key locations throughout the city
  - Reduction in transfer time: 12-> 3 mins
  - Reduction in transfer distance: 300 -> 50m

#### Establishment of an integrated transit fare card system

- Not applicable just to Seoul but the whole metropolitan area
- **Reduced citizens burden of transportation costs considerably**
- People can use public transport including the bus, subway, and taxi with a single card anywhere in Korea
- Rechargeable
- Uses of T-money
  - By 2013- 97.10%

- Bus 97% of all passengers
- Subway 100%
- Taxi 59%

#### *Improvement in bus vehicles*

- CNG or Electric buses that are free of exhaust or noise
- **Introduced low floor buses in 2003 to help those with disabilities as well as children and seniors**
  - 2,703 low floor buses which accounts for 29.9% of the total number of buses under operation

#### *TOPIS*

- TOPIS- integrated transportation management center
  - Manages real time traffic flow/ supply information on traffic congestion
  - Support scientific transportation administration
  - Real time management of bus operations
  - Operate vehicle enforcement systems
- Get information
  - SNS, smartphones, web, real time SMS, street digital signage (1,141), OpenAPI
- Types of informations
  - Bus location map matching services
  - Calculation of estimated bus arrival time
  - Handling incidents
  - Bus operation and interval management
  - Analysis of bus operation data
  - Information on bus locations and speeds
  - Information on bus stop departure and arrival times
  - Information on incidents
- 3.77 million use the internet and mobile web and smartphone apps to access this information
- Smart city management
  - Transportation + disaster + safe

## Munich, Germany

“Verkehrsverbund: the success of regional public transport in Germany, Austria and Switzerland”

By John Pucher and Stefan Kurth

### 1. Verkehrsverbund system in Germany

- a. Verbund System has been very successful in attracting more public transport riders, increasing the public transport's share of modal split
  - i. A modal share (also called mode split, mode-
    1. The first transportation systems in Germany were “cumbersome, time-consuming and expensive”
  - ii. As a result gov officials, towns, cities and seven public transportation share, or modal split) is the percentage of travellers using a particular type of transportation or number of trips using said type
- b. Success of system
  - i. Service expansion, improvement in service quality, more attractive fares and extensive marketing campaigns
- c. Origins of Verkehrsverbundfirms banded together to form the Hamburger Verkehrsverbund (HVV) in 1967 to coordinate all services
  1. First system where users would need only one ticket and one integrated time table for the entire trip from origin to destination
  2. Bus stops, U-Bahn (metro) stations, S-Bahn (suburban railroad) stations, and ferry docks are carefully coordinated
  3. Has a central organization (usually operated by Gov) that owns or is heavily subsidized all private and public transportation systems
    - a. In Berlin the S-Bahn is a subsidiary of the Deutsche Bahn, the national railway but is also part of the Transport Association Berlin-Brandenburg (VBB)
- d. Zurich
  - i. Connection of services cover a wide area
    1. S-Bahn (suburban rail) and U-Bahn (metro) work together to provide almost all long-distance travel
      - a. Crucial links between outlying 281 portions of the Verbund regions and their central cores
      - b. U-Bahn primarily designed to provide high-speed travel within the urban core of each region

- c. Diesel bus, trolley bus, minibuses and van services are designed as feeder and distribution routes to bring passengers to and from the rail network
- ii. Success of public transport
  - 1. Saw a large increase in ridership after coordinating schedules and improving advertisement of transit system
  - 2. **Increased the frequency of services** of their existing rail and bus services
  - 3. Created a timetable with route and fare information for each customer
    - a. User would input their point of origin, their destination, time of day and the computer program would calculate the quickest and cheapest route
    - b. **Presenting useful information to users in a easy to read format**
      - i. Route, schedule and fare information at every rail station and bus stop
  - 4. New services introduced to fill in the market gaps not served well by rail or conventional fixed-route bus services
    - a. **Extend coverage of transportation system**
    - b. Range of vans, minibuses and taxi services were added
    - c. Park and ride, bike and ride encourage more public transportation usage
  - 5. Ridership growth through better quality service
    - a. Analysis shows the more money spent on improving the quality of the system there was a linear increase in ridership
    - b. **Speed and dependability** are important determinants of transportation choice
      - i. Minimize transfer times between different modes and lines
    - c. Buses and Trams have **reserved rights of way in street medians**
      - i. Undertaken measures to accelerate bus and tram services to improve their on-time performance
      - ii. “Steadily expanded their networks of reserved bus lanes in order to insulate buses from delays resulting from roadway congestion” (284)

- iii. Tram lines have dedicated zones on side of road to improve time efficiency
  - iv. Computerized traffic systems have been installed to give buses and trams priority access to intersections shared with cars and trucks
    - 1. By doing so it enabled “90% of trams to adhere perfectly to their timetable” (284)
  - d. Improved the quality of bus and bus stations for comfort, protection from weather, and the overall quality of their vehicles
    - i. **comfort, higher capacity, and easier exit and entry**
- 6. Ridership growth through more attractive fare structures
  - a. Uniform, integrated fare structure
  - b. Pay for one ticket from origin to destination
    - i. “Even if passengers transfer from one line to another, from one type of public transport to another, or even from one public transport firm to another, only one ticket is needed for the entire trip from point of origin to destination.” (285)
  - c. Offering monthly passes, give deals to buy them to encourage daily use
  - d. Also offer deals for students
  - e. Monthly tickets are made even more attractive because they are transferable from one person to another
  - f. Credit and debit cards accepted to buy tickets
    - i. **Offer many ways to purchase a ticket (online website, app purchases, etc)**
  - g. In 1990, the Verkehrsverbund Rhein-Ruhr greatly simplified its zonal fare structure by reducing the number of zones from 11 to only three
    - i. Makes it **easier for the customer to understand the transportation system**
    - ii. Study argues the simpler the system, the more likely increase ridership
    - iii. **“A simpler and cheaper fare structures (as in Rhein-Ruhr) would attract more riders” (286)**
  - h. Monthly pass, Firmmenticket, is a subsidized by large firms for their employees

7. Ridership growth through better marketing
  - a. To increase ridership, the five verbund systems have been very innovative in their marketing strategies
  - b. “Public transportation advertising appears regularly in each of the Verbund regions’ newspapers, in cinemas, and on radio and television stations. Millions of informational brochures and pamphlets are regularly distributed to all households with postal addresses in the Verbun regions” (286-287).
    - i. Emphasizes the environmental and social benefits of public transportation, and depict public transport is a safe, convenient, money-saving alternative to the automobile
  - c. Advertised reduction of various passes to encourage more people to join and ride the system
- iii. Financing ridership growth
  1. Ridership increases by expanding, modernizing and integrating their various transportation system but it costs a lot of money to do so
    - a. Lost revenue when making discounts on passes
    - b. Operating ratio fell from 64% in 1990 to 55% in 1993
      - i. In finance, the Operating ratio is a company's operating expenses as a percentage of revenue.
  2. Had to increase subsidies from government to account for loss in revenue
  3. Possible explanations for deteriorating financial situation of most Verbund systems
    - a. Public transportation does not follow an elastic model
      - i. “Lower fares will indeed increase ridership, but the percentage growth in passenger trips is far less than the percentage reduction in fares,”
      - ii. The degree to which demand or supply reacts to a change in price is called elasticity. Read more: Economics Basics: Elasticity
    - b. To reduce costs/improve efficiency Germany “there has been more emphasis on traffic control measures to increase bus and tram speeds through **reserved lanes and priority traffic signals**”

- c. Adequate government support of public transport is crucial to its continued success
  - i. To help pay for increase in services/improvements study recommends an increase in taxes, fees and charges for automobile ownership and use
  - ii. Increase in auto taxes would produce enormous new revenues, reduce congestion, increase/encourage public transportation and help the environment

The successful transportation system and the regional planning problem: An evaluation of the Munich rapid transit system in the context of urban and regional planning policy by Kreibich, V

#### Evaluation of Munich's Cycle Route Planner Data Analysis and Customer Survey

1. Overview
  - a. Analyzed the Cycle route of cyclists and their use of public transit
  - b. Created an app that will show routes that link up to public transit
    - i. "cycle routes and other new bicycle infrastructure to the route planner and improve the system continuously. It provides a navigation and map service especially for the requirements of cyclists and can be combined with the use of public transport" (225)
2. Literature Review
  - a. Web-based cycle route planners have recently been developed
  - b. Singleton and Lewis (2011) combined bicycle accident information with bicycle route planning, using London as an example
    - i. Analyzed the quickest route and an accident avoidance weighted route, found avoided the high accident volume did not increase trip length significantly (226)
3. Online Route Planners and Navigation tools

- a. Different path planning modes depending on what kind of cyclist you are (i.e. families, commuters, sport cyclists etc)
    - i. “Route selection modes, start and destination points, personal adjustments like speed level or type of cyclist, as well as data collection in form of GPS tracks, are crucial for the development of a cycle route planner”
  - b. Munich’s Cycle Route Planner
    - i. Enter address or location for origin and destination, then presents the user three options of “fastest route”, “green route” and “family route”
      - 1. “Fastest route” represents the quickest route
      - 2. “Green route” leads cyclists among green space and park areas
      - 3. “Family route” prefers explicitly cycleways, traffic calmed areas and avoids slopes
    - ii. Connection to public transportation system
      - 1. After choosing your route, there are three options to divide trip:
        - a. Bike: exclusive use of the bike
        - b. Bike and Ride: by bike to a station and then use public transportation
        - c. Bike entrainment: use the bike to a station, bike carried with public transport and cycling to the destination
4. Conclusion
- a. Route planner is predominantly used for leisure trips by bike and plan trips to work
  - b. Route planner, although a good idea in concept, is primarily used for exclusive bike planning and people don’t use the transit system with it