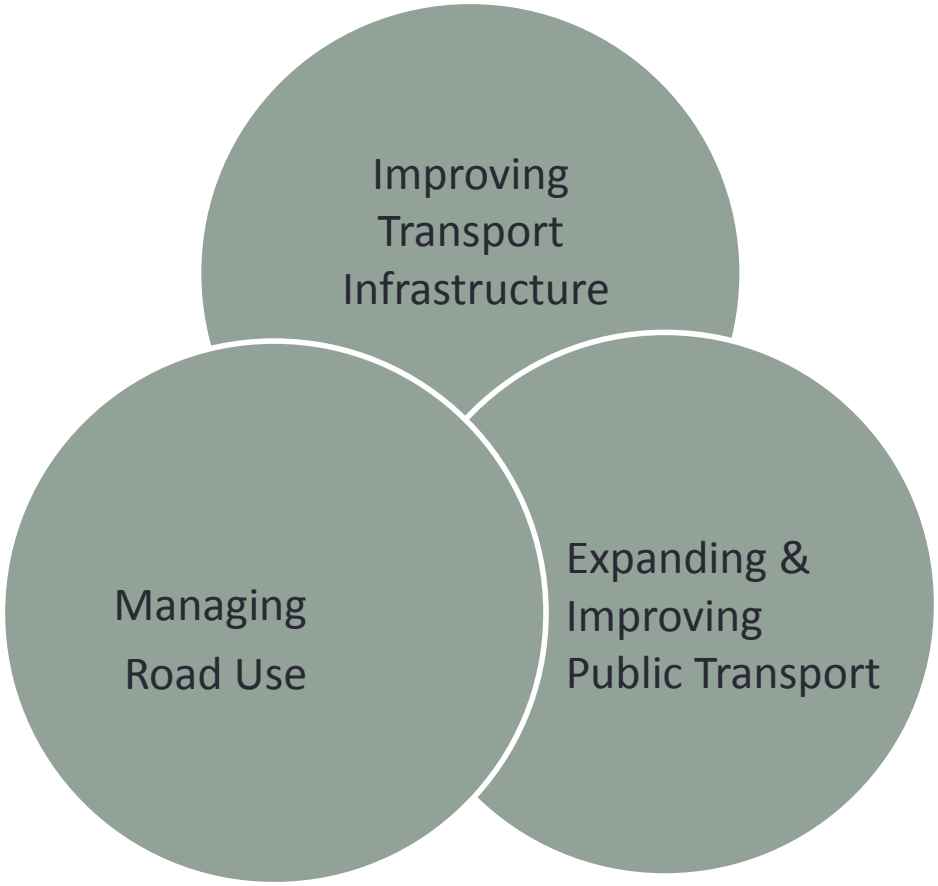
Hong Kong Tramways, Limited

Presentation for the Ideas Centre

27th March 2014

Transport Policy – 3 Pillars



HK Transport Strategies

- Build on established policies & strategies with focuses on
  - Better integration of land use & transport planning
  - Better use of railways as backbone of PT system
  - Better PT services & facilities
  - Better use of advanced technologies in transport management
  - Better environmental protection
- Emphasis on co-ordination of public transport services

Public Transport Policy - Major Principles

- Co-ordinate public transport services
  - balanced network
  - emphasis on better use of mass carriers i.e. rails & buses
- Support operations by private companies / public corporations on prudent commercial principle without direct Government subsidy
- Encourage healthy modal competition
- Provide passengers with choices at reasonable fares matched to differing levels of comfort, speed & convenience

Hierarchy of Public Transport Modes in Hong Kong (CTS-3)

Mode	Capacity	Costs to Build	Costs to Operate	Flexibility	Use in Hierarchy
Heavy Rail	Very High	Very High	Low	Low	Provides major trunk services in corridors with very high demand.
Light Rail	High	High	Low	Low	Provides trunk services in high demand corridors. May feed heavy rail or ferry.
Bus	Medium	Low	Medium	High	Provides trunk services in medium demand corridors. May feed heavy rail, light rail or ferry.
Minibus	Low	Low	High	Very High	Provides services in low demand corridors. May feed heavy rail, light rail or ferry.
Tram	Low	Medium	Medium	Low	Provides services for short trips where the low speed is unimportant and the low fare is a major advantage. May feed heavy rail.
Taxi	Low	Low	Very High	Very High	Provides specialized personal door-to-door services.
Ferry	Medium	Low	High	Low	Provides essential services for the outlying islands and supplements other modes in the inner harbour.

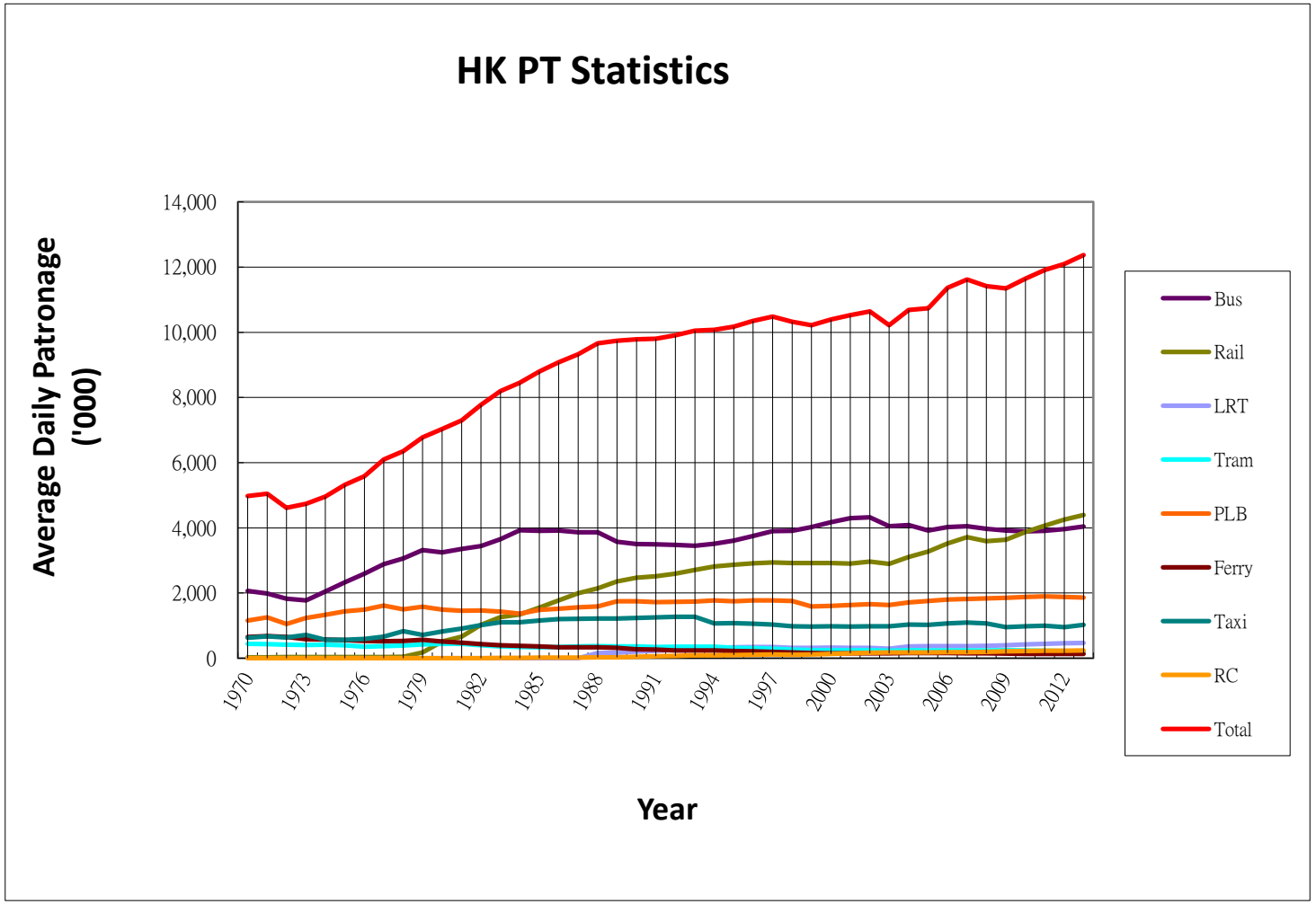
HK PT Operating Environment

- High population density
- Land development & associated transport infrastructures / services well planned
- Well established transport policies & strategies
- Public transport operated on prudent commercial principles
- High property price (allowing property development to support rail construction)

PT Operations - Achievements

- High proportion of personal trips on public transport - about 90% of personal trips
- Comprehensive transport network with competition & choices for passengers at reasonable fares
- Efficient & effective operations
- Operators largely self sufficient without substantial Government subsidy

HK Public Transport Statistics



PT Market Share (2003 – 2013)

Mode	Daily patronage (000')					
	2003		2013		2016	
	No.	%	No.	%	No.	%
Franchised Bus	4,047	38	3,908	32		?
Rail	2,999	28	4,395	36		40-50
LRT	291	3	470	4		?
Tram	224	2	198	2		?
PLB	1,631	15	1,860	15		?
Ferry	146	1	136	1		?
Taxi	975	9	1,020	8		?
Residents' Bus	174	2	239	2		?
MTR Bus	71	1	131	1		?
Peak Tram	8	0	17	0		?
Total	10,566	100	12,374	100		

HK Tramways

- Largest double-deck tram fleet still in operation in the world
- Patronage 200,000 per day (73,000,000 per year), around 15% of intra-HK Island public transport trips
- An essential service for short trips charging low and affordable fares (socially important and popular with the elderly)
- Greenest transport mode in Hong Kong (lowest carbon footprint)
- A key city heritage, an important touristic asset for HK (no tour to Hong Kong is complete without a ride on the trams)

System Characteristics

- Operation
  - Regular service
    - Operating Hours : 5:30 A.M. to 12:30 A.M.
    - Frequency : approximately 1.5 minutes in peak hours
  - Tram hire (by two open-top antique trams)
- No. of staff : 640 (around half being motormen)
- No. of trams :
  - 164 (length 9,000 mm & width 2,000 mm)
  - Ordinary tram carrying capacity : 115
  - Antique tram carrying capacity : 80
- Tram track
  - Total length : 30 Km
  - Track gauge : 1,067 mm
- Tram stops
  - Total No. : 111
  - Average interval : 250 metres
  - Most in the middle of the road connected by pedestrian crossings or footbridges

Tram Routes

- Depots
  - Whitty Street (1.28 hectares)
  - Sai Wan Ho (0.7 hectares)
- Termini
  - Shau Kei Wan
  - North Point
  - Causeway Bay
  - Happy Valley
  - Kennedy Town
  - Whitty Street
  - Western Market
- Tram routes
  - Shaukeiwan ↔ Western Market
  - Shaukeiwan ↔ Happy Valley
  - North Point ↔ Whitty Street
  - Happy Valley ↔ Kennedy Town
  - Causeway Bay ↔ Kennedy Town
  - Western Market ↔ Kennedy Town

Timeline

1881	Tramway system proposed for Hong Kong
1901	Proposal accepted by Hong Kong Government
1904	26 single deck tramcars built in the UK shipped to Hong Kong
1910	Name of the company changed to The Hong Kong Tramways Ltd
1912	First open-top double-deck tramcar introduced
1925	Enclosed double-decker trams replaced open-top trams
1932	North Point Depot came into service
1941	Japanese occupation took place (very limited tram service maintained by 12 tramcars from Causeway Bay to Western Market)
1945	End of Japanese Occupation (all 109 tramcars remained but only 15 operational)
1949	Single-track system substituted by double track system
1954	North Point Depot closed; Russell Street Depot expanded and renamed Sharp Street Depot
1965	22 single deck trailers (capacity : 36) serving first class passengers introduced by phases (withdrawn in 1980′)
1972	Differential fares abolished and flat fare introduced
1974	Hong Kong Tramways Ltd acquired by Wharf Holdings
1976	OMO introduced with fare collection by coin-boxes in lieu of conductors
1989	Sharp Street Depot closed and function split between Sai Wan Ho and Whitty Street depots
2001	Octopus payment system introduced
2008	Air-conditioning installed on antique tram #128
2009	Hong Kong Tramways Ltd acquired by Veolia-Transdev – RATP
2010	Newly renovated trams put into operation
2011	RFID system introduced for real time tracking of trams

1904

1912

1918

1940

1950

1960

1970

1980

2000

2000 (Millennium Tram)

2011

Ticket Punch & Tickets

Tourist Attractions

Apart from the heritage look, the passengers can enjoy sightseeing on the trams. Travelling in the lower deck of the tram allows travelers to have a close up view of the local street life, while occupying the front seats on the upper deck gives good views of the city from above as the tram rattles by. In a way, the tram journey can offer a reflection of the local society in microscopic scale, which enables a deeper understanding of the lifestyles in Hong Kong.

Tram Operation - Environmental Scan

	Positive Forces	Negative Forces
Governmental	Need to maintain financial viability Recognition of popularity of tram services for certain group of people	Rails as backbone and plan for continual expansion Tram services supplementary to other public transport services Priority for use of road space often given to general traffic in particular buses
Economical	Low inflation rates Increase in advertising income with economic boom	Patronage decline with economic boom Shortage of labour supply and competition in market leading to surging staff costs Ever increasing costs for products / equipment
Financial	Stable returns so far Low cost base Less subject to impact of fuel price increases Catchment along busiest corridor of HK Island	Lack of incentive for investment Limited Government subsidy Subject to effect of uncontrollable events e.g. economic fluctuations etc Difficulty in getting fare increase
Social	Increasing support for green transport Low fares more meeting affordability of those being worse off Demand for choice of PT modes	Concessionary fares for senior citizens on other public transport modes
Political	Good image – heritage and low fare Recognition of initiative for service improvement	Resistance to fare increase Request for further fare concession Pressure for tram noise reduction
Technological	More supports for operational efficiency and effectiveness	More rooms for improvement by competing modes

Market Analysis

- Factors affecting the overall (public transport) market size
  - Limited population growth with continual shift to New Territories
  - Increasing demand for long work trips
  - Continual expansion of railway network
  - Deterioration in road traffic conditions
- Segments with high unrealized potential
  - Car users (subject to Govt policies)
  - Tourists & passenger on recreational/leisure trips

Competitive Analysis

- Major competitors
  - Railway operators in particular opening of West Island Line at end of 2014
  - Franchised bus operators
  - Other PT modes at local level i.e. PLB
- Benchmark against competitors
  - Advantages
    - Low fares
    - Convenience
    - Simple routing
    - Catchment in busiest areas on HK Island
    - Popularity for short trips and elderly
  - Disadvantages
    - Slow speed (commercial speed <8 kph; -16% in 5 years)
    - Subject to effect of road congestion
    - Lack of air-conditioning thus a deterrent effect on passengers during hot seasons
    - Lack of fare adjustment mechanism

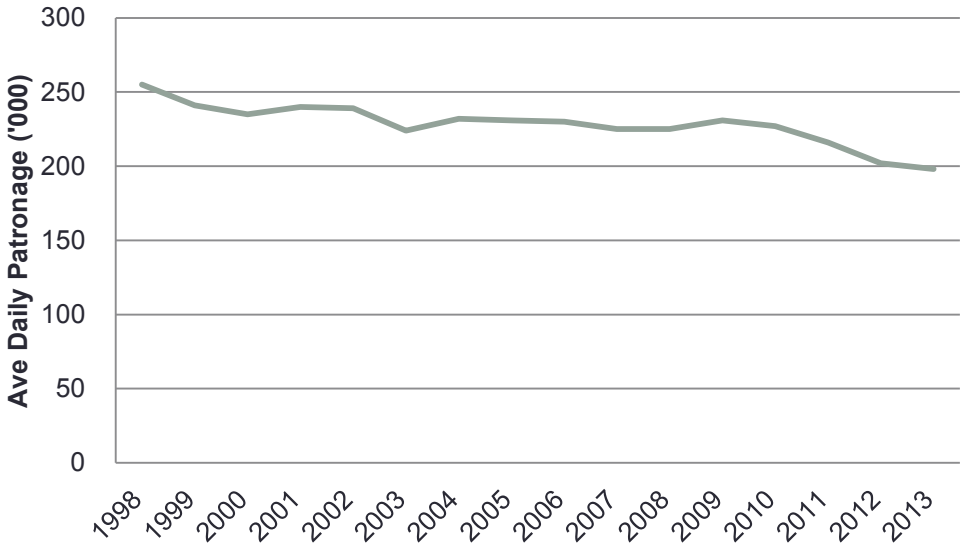
HKT's Financial Model

- Full commercial operation despite low fares
- Competition with 50+ bus routes, MTR, minibuses etc
- Revenue structure
  - Farebox (60+%) - countercyclical/seasonal
  - Advertising (30+%) - strongly procyclical/volatile
- Cost structure
  - Payroll (70%)
  - R & M (15%)
  - Energy (6%)
- Structural threshold effects
  - Cost increases : continuous
  - Fare adjustment : rare occasions

HKT's Financial Highlights

- Stagnant fare revenue (despite 2011 fare increase due to patronage loss)
- Continual cost inflations (salary, electricity, spare parts etc) despite strict cost controls
- Failure to achieve cost recovery solely by traffic revenue
- Heavy reliance on advertising revenue
- … ??? ad revenue being notoriously volatile (-40% in 2009), and cannot grow forever

HK Tramways – Ave Daily Patronage



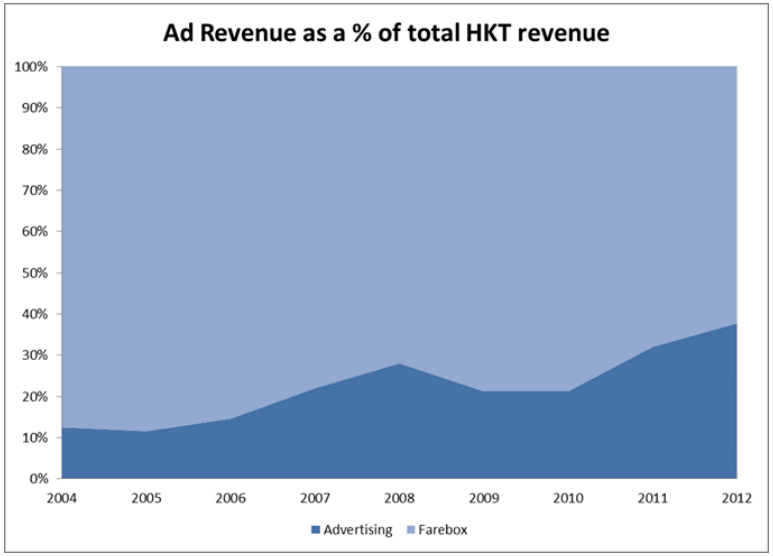
	HK Tramway **('000)**	HK Total **('000)**
1998	255	10265
1999	241	10331
2000	235	10525
2001	240	10683
2002	239	10880
2003	224	10566
2004	232	11045
2005	231	11171
2006	230	11364
2007	225	11616
2008	225	11415
2009	231	11344
2010	227	11646
2011	216	11913
2012	202	12093
2013	198	12374

Passenger Satisfaction Survey – Influencing Factors on Tram Ridership

- Frequency (rush hours)
- Driver's driving behaviour
- Riding comfort (cabin interior)
- Accessibility of tram stop
- Fare level
- Riding comfort (crowdedness)
- Safety
- Passenger information
- Frequency (non-rush hours)
- Service reliability
- Tram speed

Advertising : Outperforming Market

- Highly volatile business, amplifying economic cycles
- Revenue structure (% of advertising income in total revenue)
  - HKT : 35+%
  - Bus operator : 2%



Tram Improvement Measures

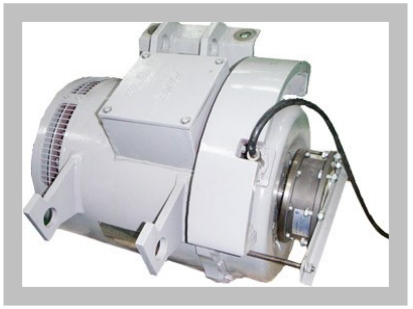
1) Track Maintenance (Weld & Grind)
   - On-going

2) Overhead Wiring System (Parafil Rope)
   - Completed

3) Traffic Light Synchronization
   - 5 junctions operational

4) RFID Tram Positioning System
   - Real time passenger information (QR code & APPs)

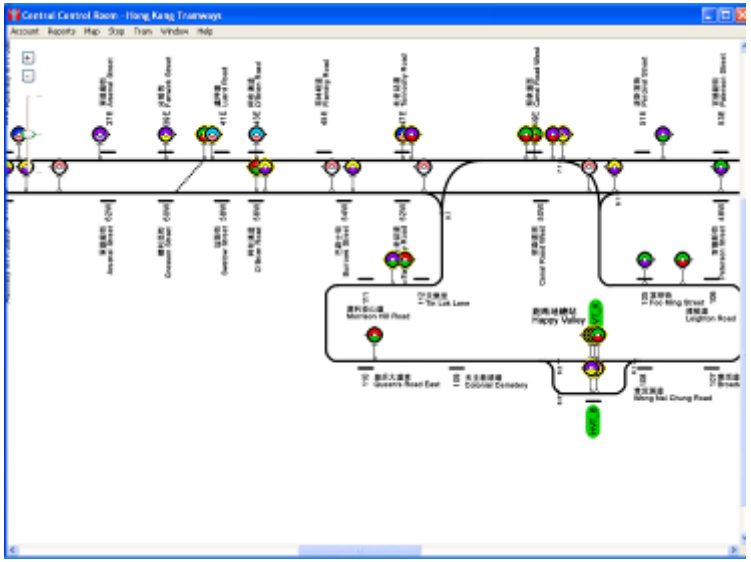
5) “Tram Renovation”
   - AC traction motors
   - Aluminum body
   - New electromagnetic braking system
   - New interior
   - ➔ 30+ trams completed

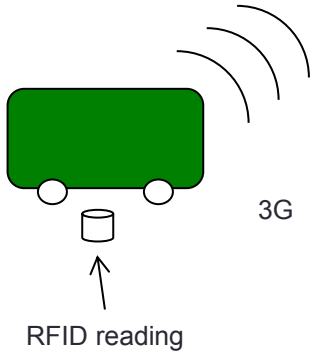


Comfort : Signature Trams (100% Home-made)

Real-time Positioning System

- 1st ground level real-time positioning system in Hong Kong
- Choice of RFID technology – 600 passive tags buried along the tracks
- Dynamic map to show real-time positions in Operation Control Centre
- Better match offer/demand, reduce tram bundling and improve reliability
- Enable provision of real-time information to passengers





Real-time Passenger Information

Implemented

Under deployment

Matching Frequency & Ridership

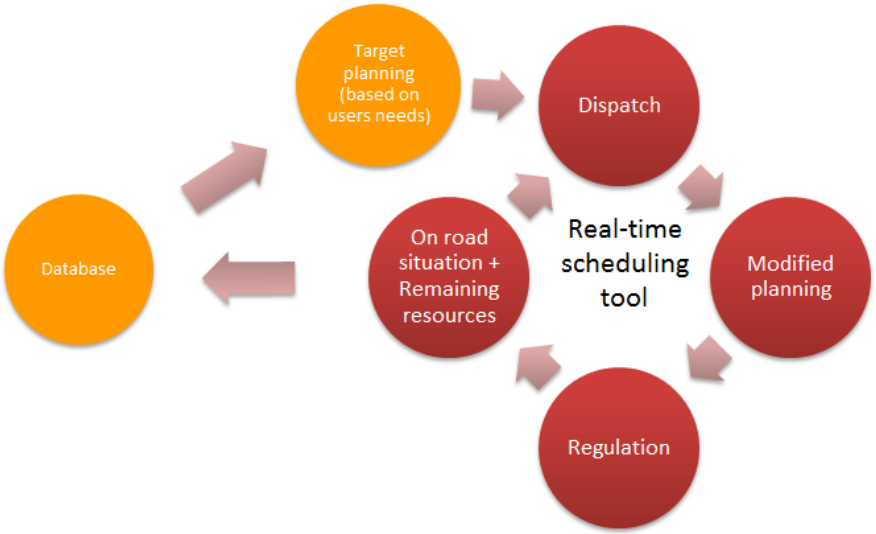
Stage 1 (2013)

"Scientific Scheduling"

Stage 2 (Target Summer 2014)

"Trial on real-time optimization tool"

- R&D project with CUHK
- Objective : real-time optimization of tram car dispatches

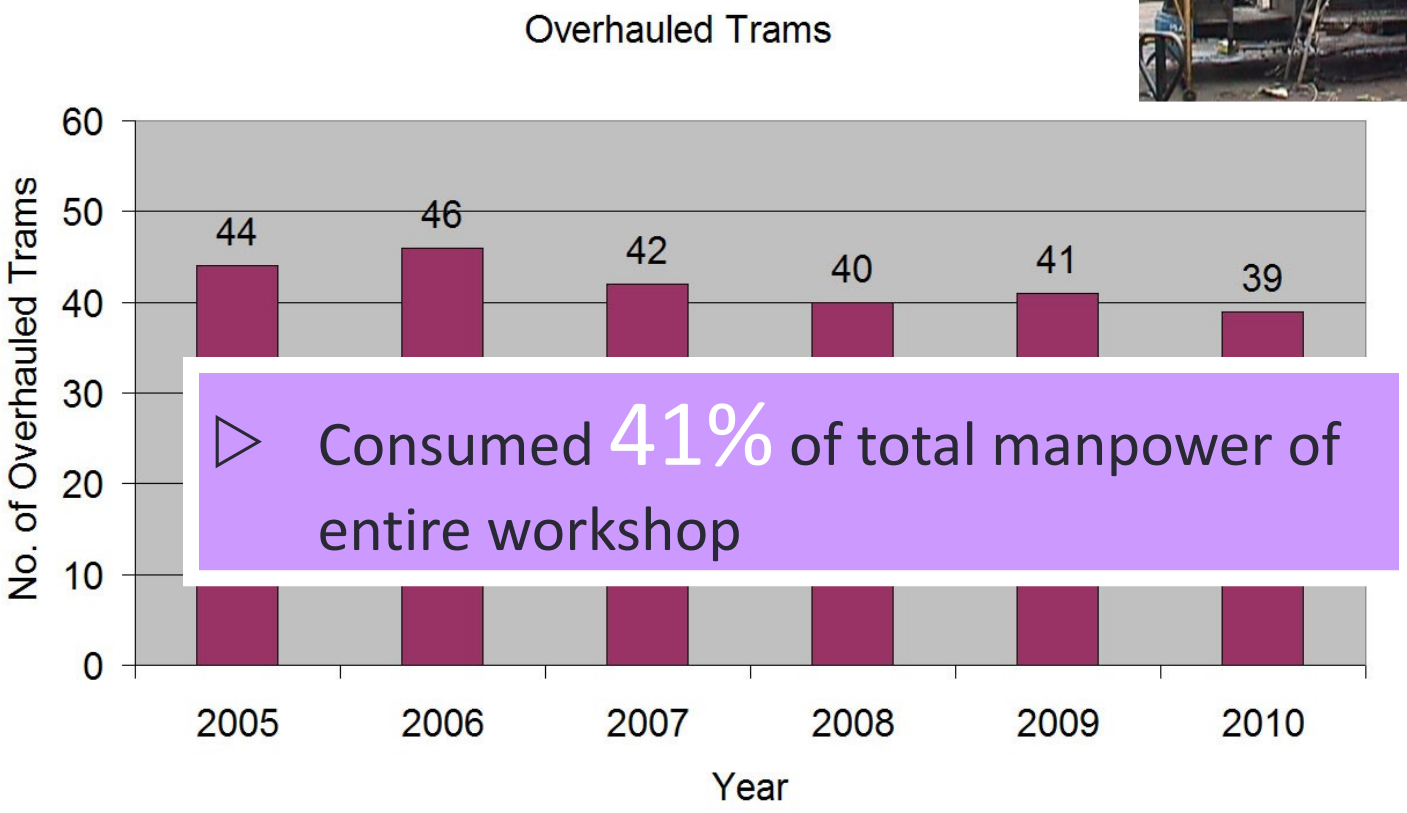


New Engineering Projects

- Maintenance Tram
- Wheel/Rail lubrication
- Wheel profile machining
- Primary suspension
- Brake system improvement
- Air conditioning

New Tram Car Body

- Heavy maintenance cost for car body maintenance
- Overhauled around 40 tram car bodies each year in 2005 to 2010



▷ Consumed 41% of total manpower of entire workshop

Features / Benefits of New Tram Car Body

- Aluminium tram cars' safety, reliability and cost-effectiveness proven
- Fire approved reinforced fiberglass panels and staircases leading to prolonged service life of tram car body

Aluminium tram cars manufactured in 2000

Features / Benefits of New Tram Car Body

- Traditional tram car body appearance maintained

Traditional tram car

New tram car

Features / Benefits of New Tram Car Body

- LED Destination Blinds

Traditional tram car

New tram car

Features / Benefits of New Tram Car Body

- PA System

New tram car

Features / Benefits of New Tram Car Body

- CCTV

Traditional tram car

New tram car

Features / Benefits of New Tram Car Body

- Driving Cabinet

New tram car

Traditional tram car

Features / Benefits of New Tram Car Body

- New Seat Arrangement

Traditional tram car

New tram car

Features / Benefits of New Tram Car Body

- New Seat Design

Traditional tram car

New tram car

Features / Benefits of New Tram Car Body

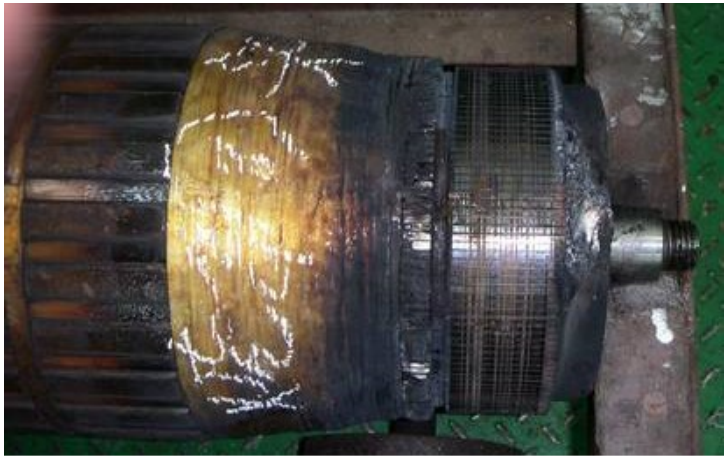
- Flap Entrance Gate

Traditional tram car

New tram car

Development of AC Traction System

- High cost for DC traction motor maintenance
- Advantages of new AC traction motor: high reliability, high efficiency and low maintenance cost



Armature of DC motor

AC motor

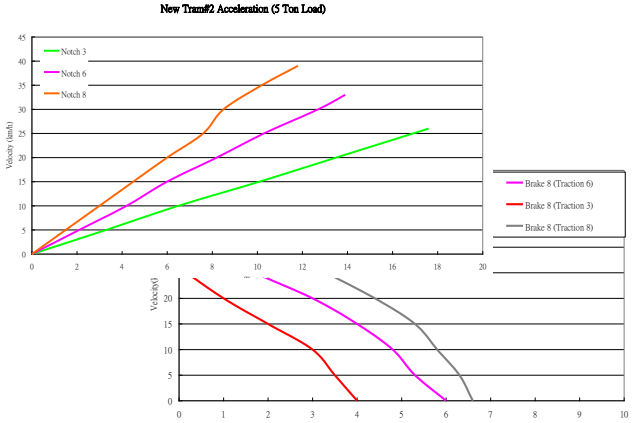
- IGBT Inverter power control enable variable voltage and variable frequency (VVVF) speed control including anti-skid during tram braking

Development of AC Traction System

- Featuring regenerative braking
  - AC motor becomes a generator when braking which generates electricity for feeding back into the supply system
- Speed Control
  - Speed control system provides 8 acceleration and 8 deceleration notches
  - Direct torque control
  - Adjusts slip frequency instantaneously by reading motor voltage and current data

Driver control panel

Inverter



Smooth acceleration & deceleration

Recognitions of HKT's performance

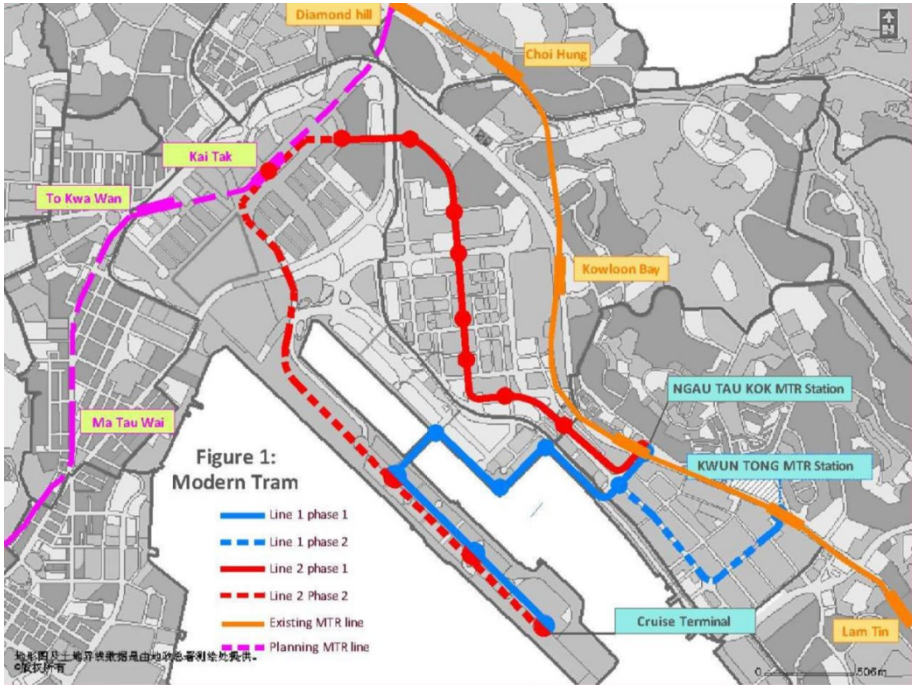
- Gold Award (Utilities), "Yi Award" (righteousness) and "Xin Award" (trustworthiness) in the 2012 Corporation Survey 2012 by Hang Seng Management College

- >95% rated "excellent" or "very good" by Tripadvisor users

- ERB Manpower Developer Award 2013-15

New Project : Kai Tak EFLS

- Kai Tak : new key development in HK with Cruise Terminal
- Gov't's plan : Monorail
  - 1st phase in 2023
  - Capex HK$12B (2012 price)
  - Breakeven fare HK$8.5
- HKT's competing proposal
  - 1st phase in 2018
  - Capex HK$2.8 B (2012 price)
  - Breakeven fare HK$3
- Extensive lobbying / PR / media strategy
- Key issues
  - Politics
  - Occupation of road-space



Kai Tak Modern Tramway Alternative Conceptual Study

Summary

	MONORAIL	MODERN TRAMWAY	BRT
Operational	• Earliest opening in 2023 • Little flexibility for extension • Forced vertical access • Daily capacity not extendable above 200k passengers (average capacity per car)	• Earliest opening in 2018 • Flexible in construction and line extension • At-grade accessible by all • 100% spare capacity reserve (highest capacity per car)	• Earliest opening in 2018 • Line extension limited by exclusive right-of-way • At-grade accessible by all • Lowest daily capacity, just 100k passengers (lowest capacity per car)
Financial	• Costly infrastructure network required • Capital cost $12B, O&M cost $382M • Yearly operating loss $251M with fare $4/trip • Significant financial support • Breakeven fare $8.5	• Light infrastructure • Capital cost $2.8B, O&M cost $142M • Breakeven operation with fare $3/trip • Lowest financial support • Breakeven fare $3	• Light infrastructure • Capital cost $1.37B, O&M cost $164M • Yearly operating loss $81M with fare $3/trip • Average financial support • Breakeven fare $6
Environmental	• Heavy infrastructure result in visual pollution • Stations difficult to integrate in city • Green track system not possible • Environmental friendliness debatable • New landmark with strong image	• No visual, air and noise pollution • Stations easy to integrate in city • Green track system possible • Green in image and reality • New landmark with strong image	• No visual pollution • Stations easy to integrate in city • Green track system not possible • Green system subject to electric bus system • No new landmark

Closing Remarks

- Still an essential public transport service on Hong Kong Island in the years to come
- Continual patronage loss due to challenging and competitive operating environments
- Long-term sustainability dependent upon
  - Improvement to operating environment e.g. more tram only lanes and less severe traffic congestion
  - Capability for optimizing operational efficiency, effectiveness and in turn productivity
  - Diversification of business for additional income to compensate structural erosion
  - Approval for fare increase (last resort)

Safety Notes for Visit

- Always escorted by HKT staff
- Do not touch any materials, machinery or equipment
- No smoking while in depot
- Watch where you are walking for uneven ground, slippery surfaces, pit etc
- Beware of moving trams (Yellow lines indicate the tram track)
- Do not use mobile phone during the visit
- No photo taking

Thank you, Enjoy a Safe Visit!