

Lloyd's Register: Transportation

Integration of passenger behaviour studies into the design of West Kowloon Terminus

Karen Priestley
Senior Human Factors Consultant
Lloyd's Register Rail

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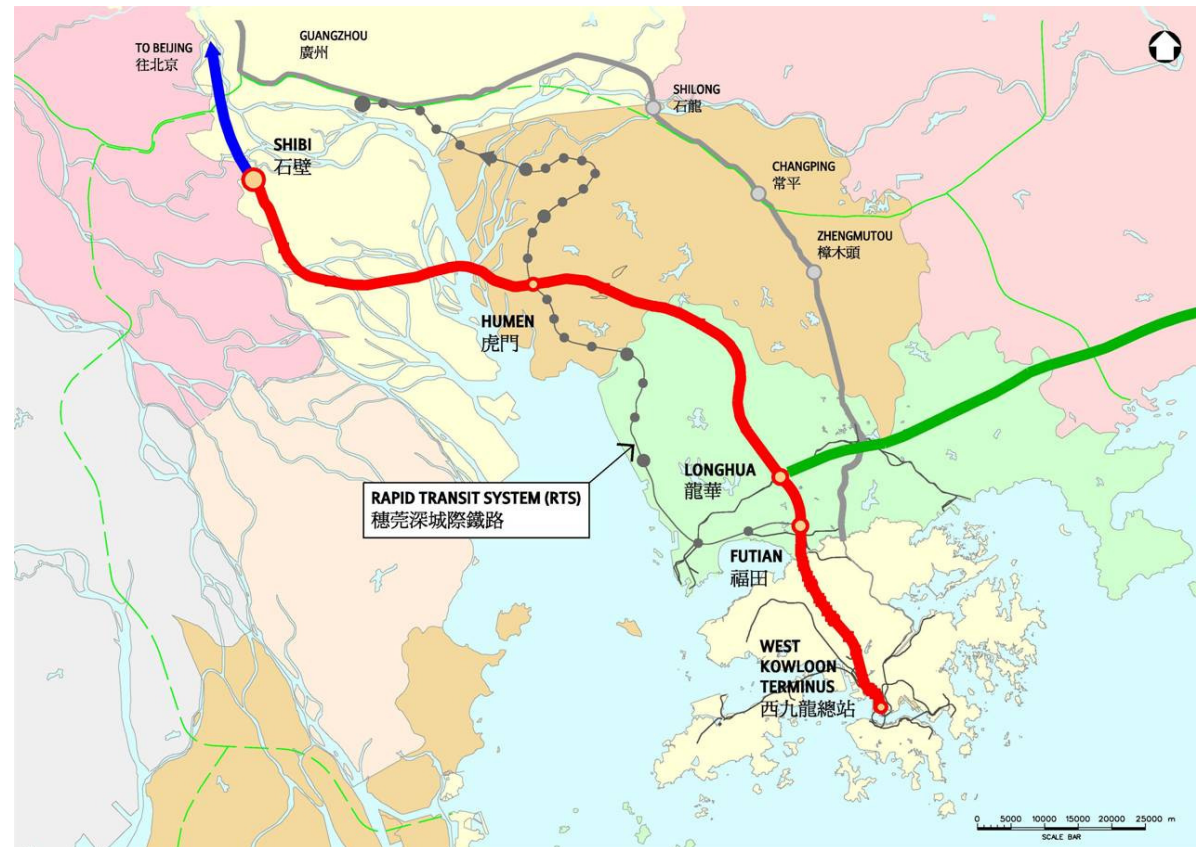
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Outline for presentation

- Background
- Findings from passenger survey and behavioural observations
- Implications for provisions in the station

Express Rail Link and West Kowloon Terminus

- The Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) will provide high speed rail services between Hong Kong SAR China
- the 'Shuttle' service provides services to Guangzhou for stations Futian, Longhua, Humen and Shibi. The patronage forecasts indicate that the majority of the patronage will be for these services .
- the 'Long Haul' services will be available through onward connections to other major mainland cities such as Beijing, Shanghai, Wuhan etc. via the national high speed railway network.
- The **West Kowloon Terminus (WKT)** will be an iconic station representing the gateway from Hong Kong into China through the high speed rail network.



Human factors introduced to WKT project

- First time requirement for consultant to include human factor support on the project
- Scope
 - Flow management
 - Safety and security
 - Level of service (including comfort and convenience)
 - Operational efficiency
 - Environment
- Activities required:
 - Develop a Human Factors Integration Plan
 - Develop a Human Factors Issue Register with 10 issues recorded that are under the control of the consultant
 - Prepare papers developing recommendations on each of the 10 issues
 - Verify that issues are addressed by the design

Luggage, trolleys and the provision of vertical circulation

- The maximum expected capacity of WKT will be 10,000 passengers per hour in each direction, each needing to bring their luggage with them through the station
- This is a potentially negative influence on passenger choice compared with bus or air travel
- One of the significant influences on the station planning was therefore the need to facilitate passengers easy transportation of their own luggage through the station
- Selected as an issue for inclusion on the Human Factors Issue Register, for further study and evaluation

Preliminary design assumptions

- Amount of luggage
 - Shuttle passengers will travel light, Long Haul passengers will carry more luggage
- Proportion of trolley users
 - 5% of Shuttle passengers, 20% for Long Haul
- Ratio of people to trolleys
 - On average each trolley assumed to be shared by two passengers (in the same travel group)
- Proportion of large and small luggage for non-trolley users
 - Shuttle 90% carry small luggage and 10% carry large luggage
 - Long Haul 55% carry small luggage and 45% carry large luggage
- The preliminary design assumptions were based on observations at St. Pancras Station in London
- The Operations Consultant on the project team was concerned whether the assumptions were really representative of:
 - Mixed service provision
 - Hong Kong / Mainland people
- Concerned that there may be under or over provision if the assumptions were significantly different from the real case

Survey and Behavioural Observations

- Survey's tailored to location
 - Hung Hom – departure and arrival halls
 - Hong Kong station – Airport Express platform
 - Airport station – departure platform
- Students covered a zone of the location and interviewed passengers where convenient
- Supervisor observed and recorded notes on passenger behaviours

	1	2	3	4
Trolley use (Y/N)				
Gender (M/F)				
Number in party				
Group Type (Fam / Busi / Leis)				
Amount of luggage	1	2	3	4
Handbags				
Computer case / briefcase				
Backpack (Small / Large)				
Unusual items e.g. box, instrument				
Standard Case / Bag <170cm (800L+600W+300D)				
Wheeled				
Not wheeled				
Large Case / Bag >170cm (800L+600W+300D)				
Wheeled				
Not wheeled				
Interview	1	2	3	4
Why have you chosen to use a trolley?				
Trolley available				
Too much luggage to wheel				
Easier to push trolley than drag luggage				
Quicker to push trolley				
other				
Why have you chosen not to use a trolley?	1	2	3	4
No large luggage				
Not aware of trolleys				
Time pressure				
Quicker to wheel case				
other				

Found that three groups of users better describe passengers than two

	Shuttle	Shuttle	'Medium' Haul	Long Haul	
Number of cases	Marketing Survey of passengers at LOW and LMC	Percentage of People Using HUH e-channel	Percentage of People HUH Guangzhou	Percentage of People HUH Shanghai	Percentage of People AEL
Hand luggage only	85% businessmen	65%	54.72%	18.14%	25.87%
0.5 (1 case between 2 people)		-	14.22%	17.53%	14.90%
1	15% other	35%	27.12%	53.40%	49.11%
1.5		-	1.65%	2.06%	2.34%
2		-	2.18%	8.25%	7.03%
2.5		-	0.08%	0.41%	
3		-	0.04%	0.21%	0.66%
6		-			0.09%
Total		100%	100%	100%	100%
Total Observations		598	1916	357	808
Total Number People		598	2659	485	1067

Estimating trolley usage

- Initial model based on usage of trolleys seen at the airport
- The profile of percentage trolley usage by amount of luggage was applied to shuttle and medium haul data to estimate the number of trolleys used
- The figures resulting from this estimate were higher than those used for the preliminary design
- The implications of the higher numbers on the requirements for lifts could not be accommodated in some areas of the station, such as the platforms
- The ratio of people to trolleys was found to be 1.4:1 rather than 2:1

WKT	Trolley	Wheeled Case	Hand Luggage Only
Preliminary design estimate	20%	36%	44%
LH	27.8%	48.8%	23.4%
Preliminary design estimate	5%	9.5%	85.5%
MH	6.5%	43.2%	50.3%
SH	2.1%	15.0%	82.9%

Impact of these results was to require more lifts than could be accommodated in certain areas of the station e.g. platforms

Passengers with different amounts of luggage

In survey, those that did not use a trolley were interested in speed, those that used a trolley were interested in ease of transporting luggage



Hand luggage only

One wheeled case
(some with computer bags integrated)



Two or more large cases

Large wheeled case

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Excessive luggage!



Passenger behaviour with luggage on escalators



Passenger behaviour with luggage on escalators



Passenger behaviour with luggage on escalators



Passenger behaviour with luggage on escalators



Reviewing the model – who are the 'at risk' groups that should use the lift for safety reasons?

- Elderly
 - Wheelchair users
 - People with Restricted Mobility (PRM) with wheeled bags (assuming the use of a cane)
 - People with vision impairments
 - People with prams
 - Anyone with large or irregular shaped luggage
 - Anyone with two or more wheeled bags
- Gives a clearer picture, can start to think of signage to inform these groups to use the lifts, also easier to identify for operators rather than just luggage size

Modeling revised, based on safety requirements

WKT	Trolley	Wheeled Case	Hand Luggage Only
LH	20.0%	54.2%	25.8%
MH	8.8%	45.1%	51.7%
MH assumption 1	7.2%	41.6%	51.7%
MH assumption 2	5.5%	43.3%	51.7%
SH assumption 3	0.0%	35.0%	65.0%

1. 50% less passengers would not take a trolley if only taking one large luggage, but would still use the lift
2. No passengers would take a trolley if only taking one large luggage, but would still use the lift
3. No passengers with only hand luggage would take a trolley

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Ease of obtaining a trolley affects usage rates (as does the need to pay for one)



Airport Station, Arrivals Platform



Entrance to Hung Hom

The need to change level impacts upon the decision to use a trolley

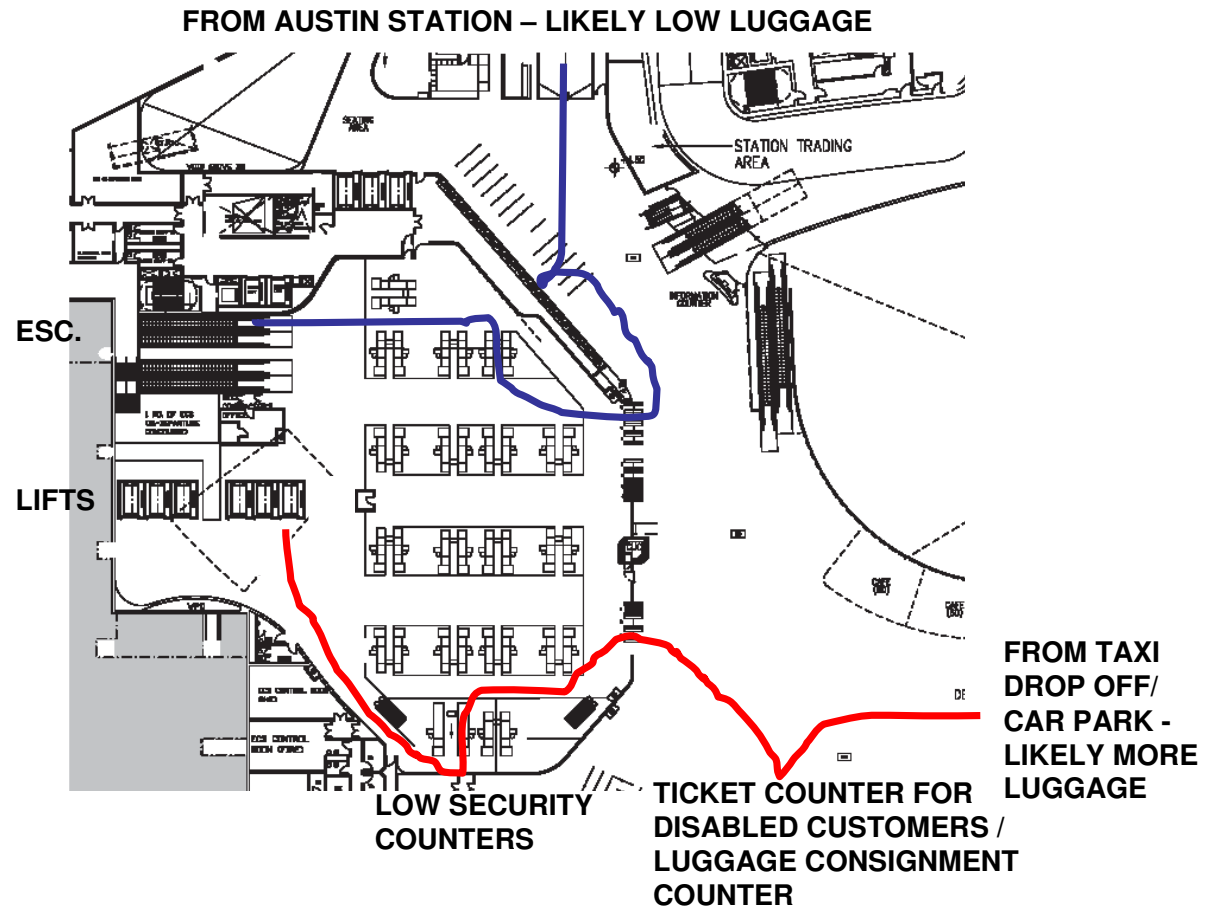
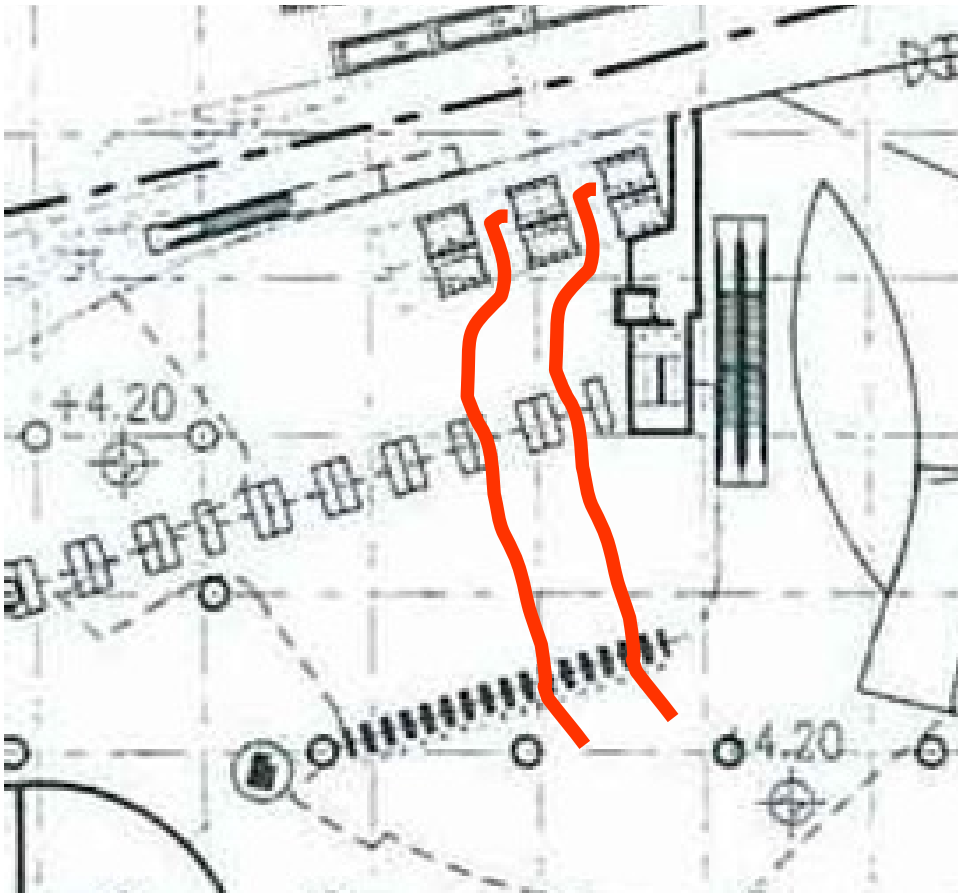


Challenge for design – to encourage 'at-risk' groups to use lifts, to facilitate fast travel for others

- Undertook task and error analysis for use of lifts and use of escalators by passengers.
- Identified potential errors that would cause the 'at-risk' groups to take the wrong mode of vertical travel
- Identified possible mitigations through design and operational controls
- Looked to incorporate design requirements into planning and detailed design
 - Two distinct paths through the station – via the lifts and via the escalators
 - Placing lifts before escalators along the path where possible
 - Examining means to highlight presence of lifts
 - Changes to signage to alert 'at-risk' groups to use lifts
 - Ensuring trolleys available, but not encouraging overuse

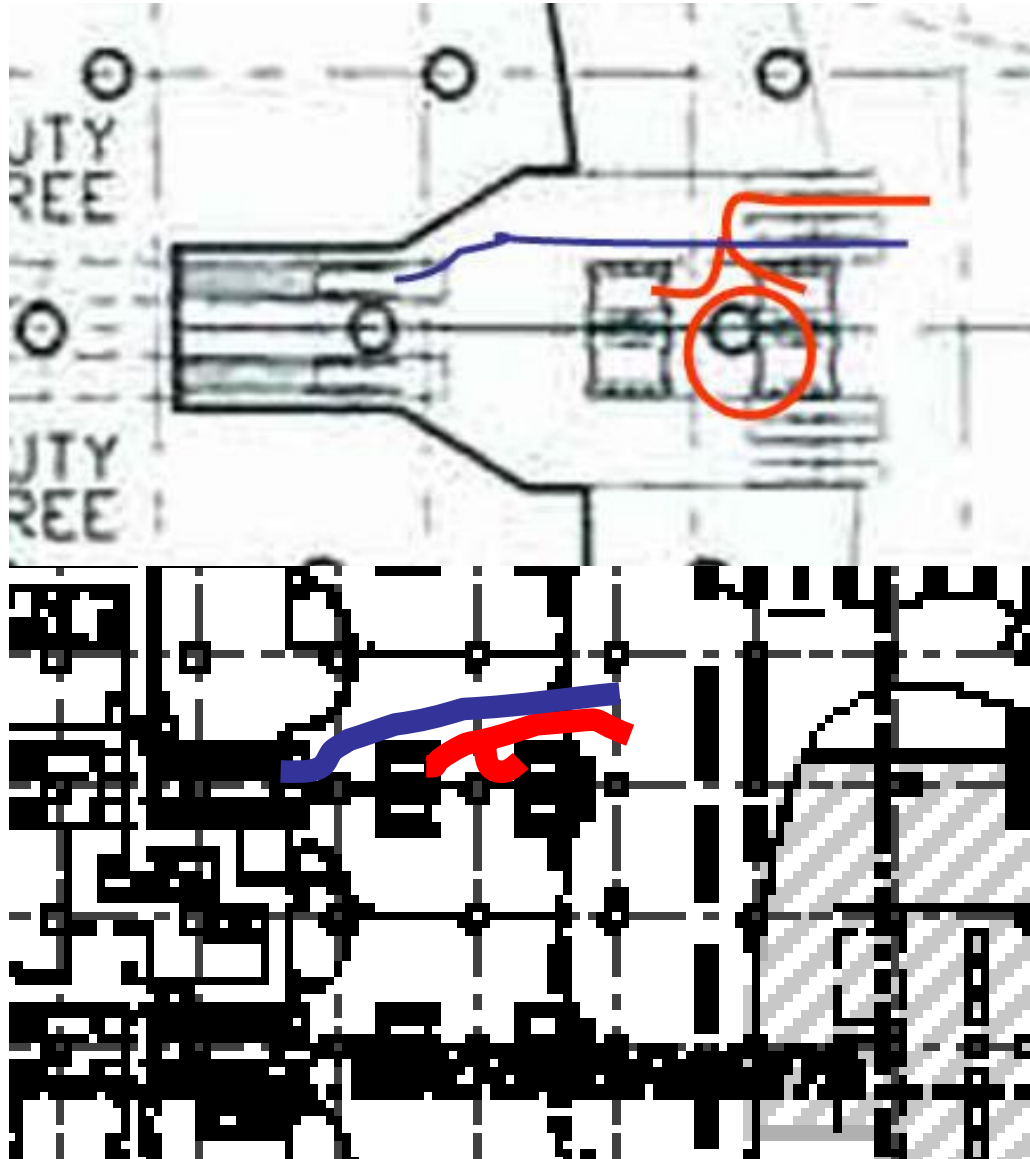
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Incorporation of requirements on ticket concourse - comparison of early plans (left) and recent plans (right)

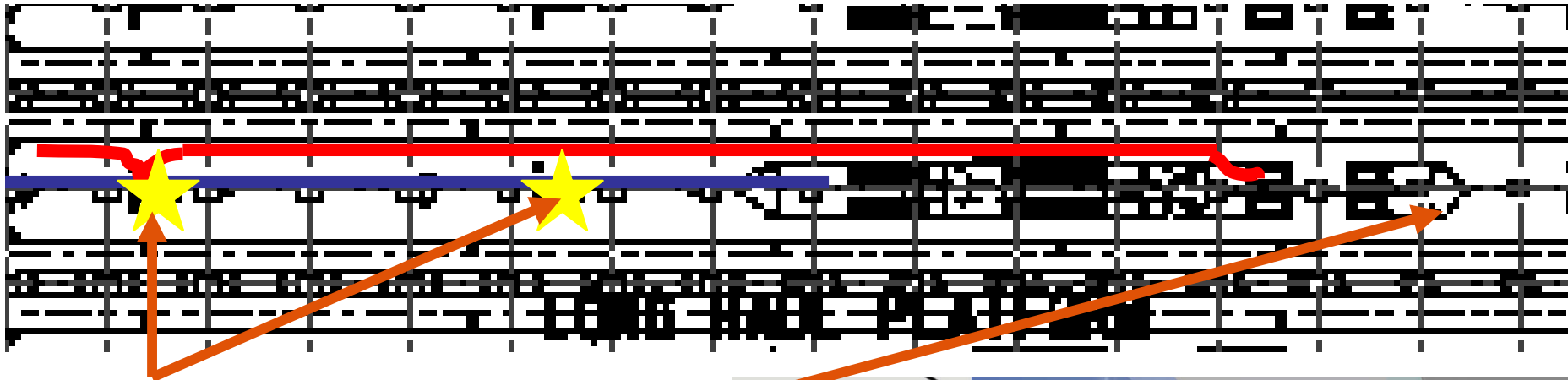


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Incorporation of requirements on departure concourse - comparison of early plans (top) and recent plans (bottom)

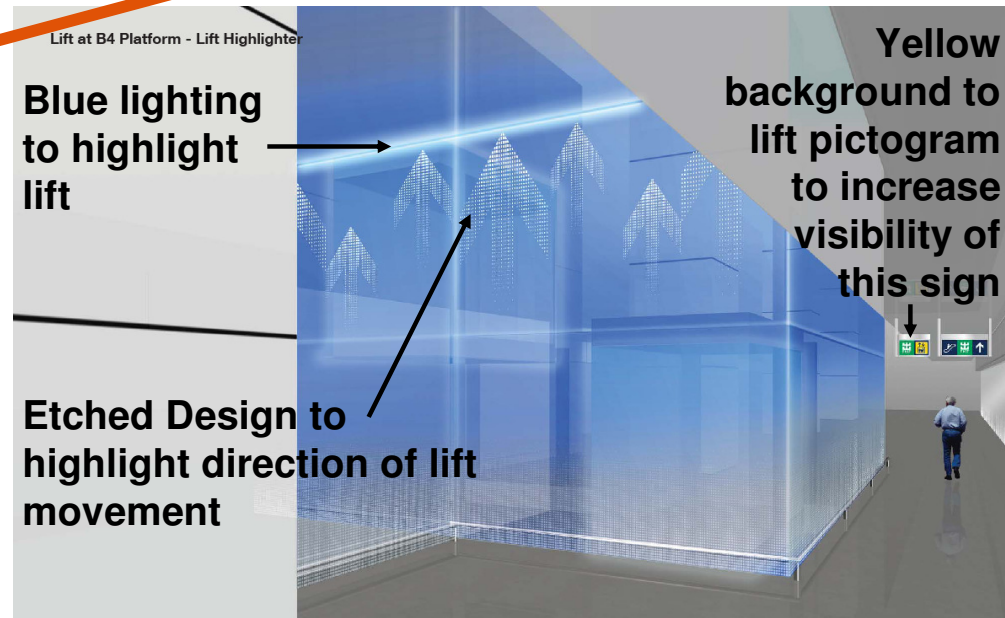


Incorporation of requirements on platforms



Trolley points

Lobbies to allow double lift provisions to be used – i.e. better than requirements based on models



Conclusions

- This project has introduced the concept of considering human factors in architectural projects in Hong Kong
- This study demonstrated that we can capture requirements for station design through techniques such as observational studies, surveys, task and error analysis that have not been articulated previously
- The value of this study has also been to face the reality of compromise in an informed manner. To demonstrate what impact the compromise will have and to understand what measures need to be taken both in design and operation to reduce impact on design goals
- There have been many lessons learned through this initial experience of human factors within the projects. Challenges for future projects include:
 - Identification of issues where human factors can add value
 - Dealing with the multiple interfaces to achieve good human factors solutions

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Any questions?



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For more information, please contact:

Karen Priestley

Senior Human Factors Consultant, LR Rail

Lloyd's Register Rail (Asia) Limited

Suite 3501 China Merchants Tower

Shun Tak Centre, 168 – 200 Connaught Road

Central, Hong Kong

T +852 2287 9344

E karen.priestley@lr.org

W www.lr.org/transportation

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