

Fornecimento de Sistemas de Sinalização para Sistemas Urbanos guiados, em Condições Extremas

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12 Setembro 2012



**Líder mundial de sistemas de informação
associados a missão crítica**

■ Três atividades principais

- Aeroespacial e Espacial
- Defesa
- Segurança
- A Investigação e Desenvolvimento representa cerca de 20% da receita



13 € bilhões de vendas



■ Um Grupo Mundial

- **67.000 funcionários** em todo o mundo
- Presente em **56 países**
- **22 500 investigadores** de tecnologias de ponta, mais de **300 invenções** por ano e **15 000 patentes**



– Presença

- Mundial (em mais de **25 países**)
- Em todos os segmentos – Metrôs (com ou sem piloto), Monotrilhos e APM's, Ferrovias Principais, Secundárias e Suburbanos
- Em todas as áreas de um Projeto – do Planejamento à Manutenção
- Adaptável e compatível com as normas internacionais e locais

– Posição no mercado

- **Experiência de 35 anos nas, 3 tecnologias – Sinalização, Comunicações e Bilhetagem**
- **Nº1 em Sistemas de Sinalização**
(Infraestrutura ETCS para Linhas de Longo Percurso e Suburbanas, CBTC e Sinalização tipo VLT, para Linhas Urbanas)
- **Nº1 em CBTC**
- **Nº1 Sistemas Integrados de Comunicações**
- **Nº3 em Bilhetagem**
(especialista em sistemas multiregionais e multimodais)

Thales nos Transportes - Portfolio



Soluções (Sistemas & Serviços) garantindo e melhorando a operação nos diversos setores dos Transportes



Ferroviás de Longo
Percorso – Carga e
Passageiro



Sistemas Metro-
Ferroviários



Rodovias

Sinalização, Comunicações & Supervisão, Bilhetagem



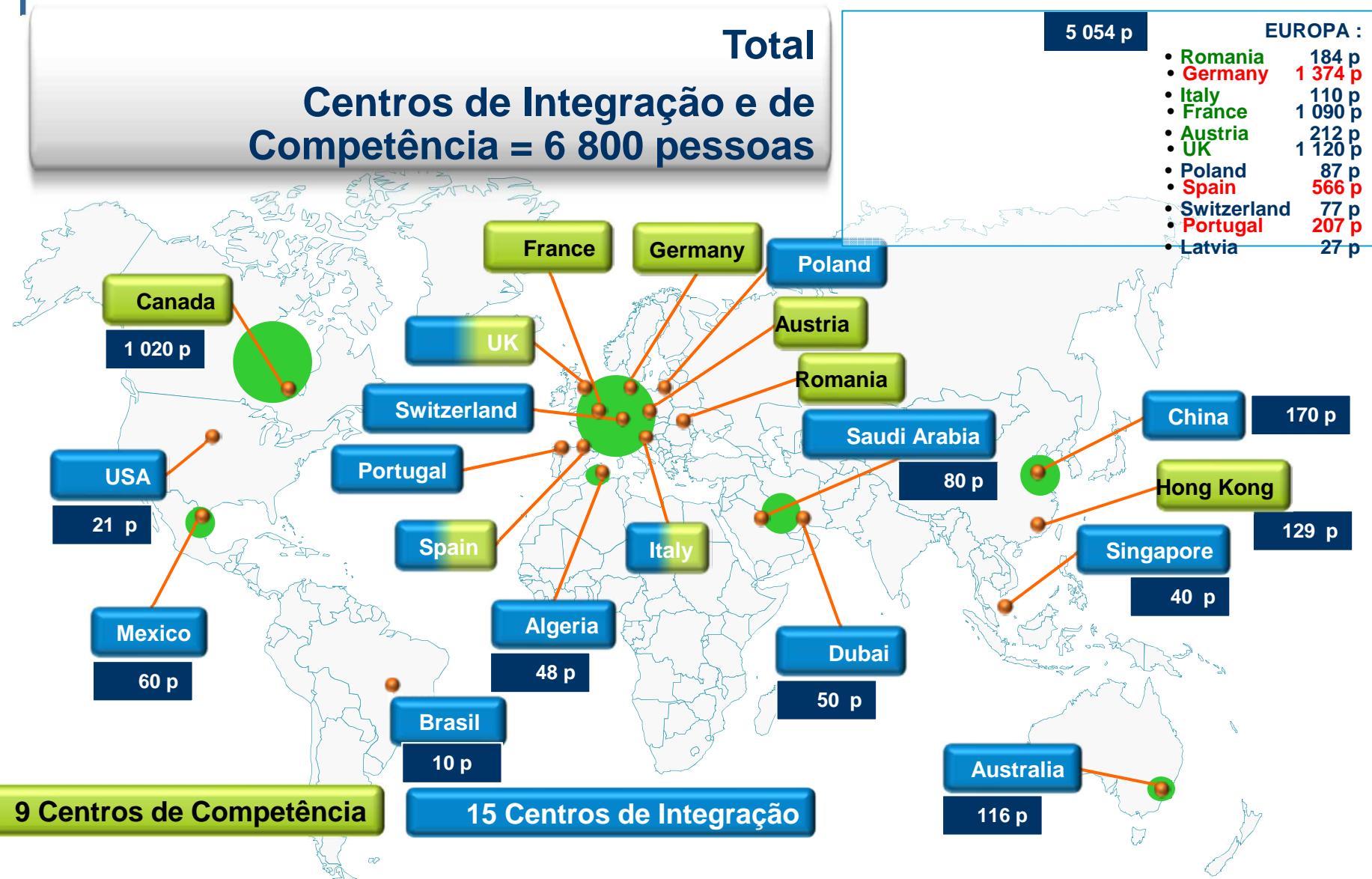
Resposta

- Controle de Trens - ETCS, CBTC
- Roteamento - CTC e Intertravam.
- Gerenciamento de Redes
- Equip de Campo – Cont de Eixo, ...

- Sistemas de Telecom Fixas
- Sistemas de Telecom Móveis
- Multimedia - Info ao Passag.
- Supervisão & Controle

- Bilhetagem
- Pedágio
- Estacionamento
- Identificação de Placa

Thales nos Transportes - Presença nos Países



O Desafio Atual dos Sistemas Urbanos sobre Trilhos



O que é o CBTC?

É um Sistema de Sinalização

- **totalmente automatizado**
- **a prova de falhas**
- **baseado na tecnologia de blocos móveis**
- **desenvolvido, pela Thales**
- **em operação há mais de 25 anos (Vancouver – 1986)**

O Desafio Atual dos Sistemas Urbanos sobre Trilhos



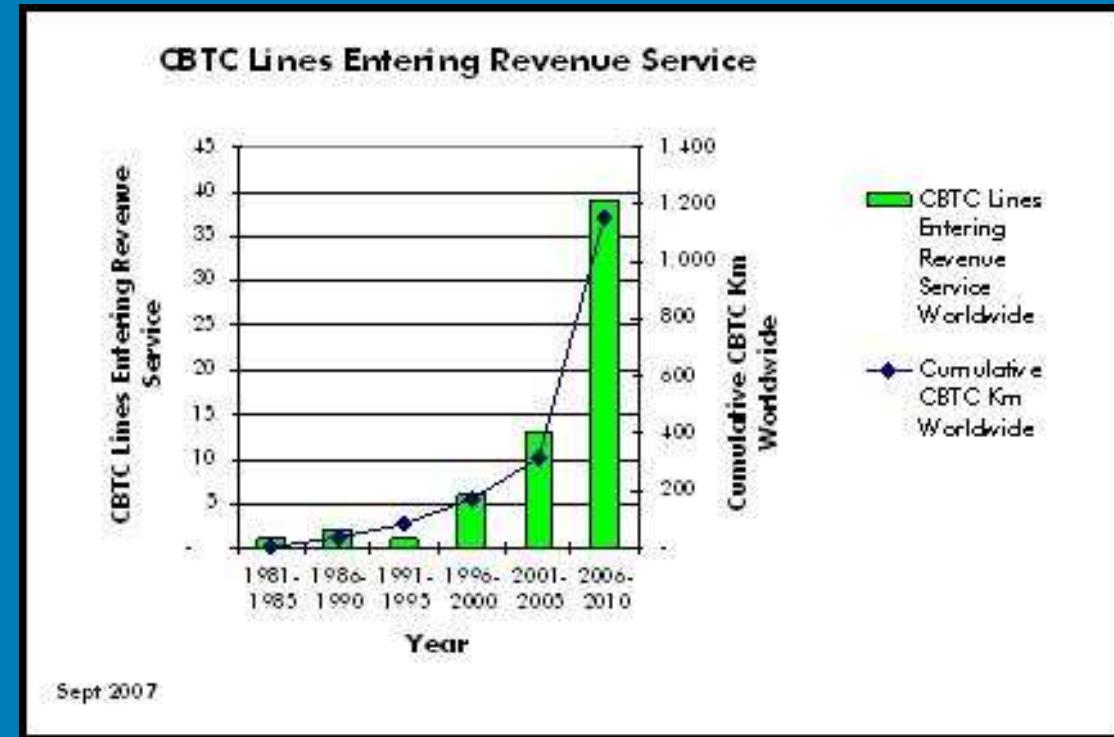
Os Desafios e as Respostas do Sistema CBTC

- **Capacidade de Transporte:** Permite intervalos entre trens de menos 90 segundos,
- **Menor Custo de Infraestrutura:** Otimiza os investimentos em obra civil, trens, subestações, via permanente, etc.
- **Flexibilidade na Expansão da Frota:** Dá maior flexibilidade (independente do tipo de trem)
- **Flexibilidade Operacional:** Dá resposta imediata a mudanças operacionais previstas e não previstas (incidentes)
- **Menores Custos Operacionais:** Reduz os custos operacionais (energia, manutenção, pessoal)
- **Máxima Disponibilidade:** Pode operar 24 horas por dia
- **Maior Segurança:** Não susceptível a falhas humanas

Como Vencer este Desafio? ↫



Como afrontar o desafio? Instalando CBTC



O número de sistemas CBTC vem aumentando de forma exponencial

CBTC IEEE – Definição & Características (1474.1)



- Localização do trem, com alta precisão e independentemente de circuitos de via
- Comunicação de dados, contínua e bi-direcional, entre o trem e o Centro de Controle Operacional
- Uso de processadores vitais nos equipamentos embarcados e não-embarcados
 - Continuous Automatic Train Protection (ATP)
 - Automatic Train Operation (ATO)
- Automatic Train Supervision (ATS)

CBTC - Princípios de Segurança

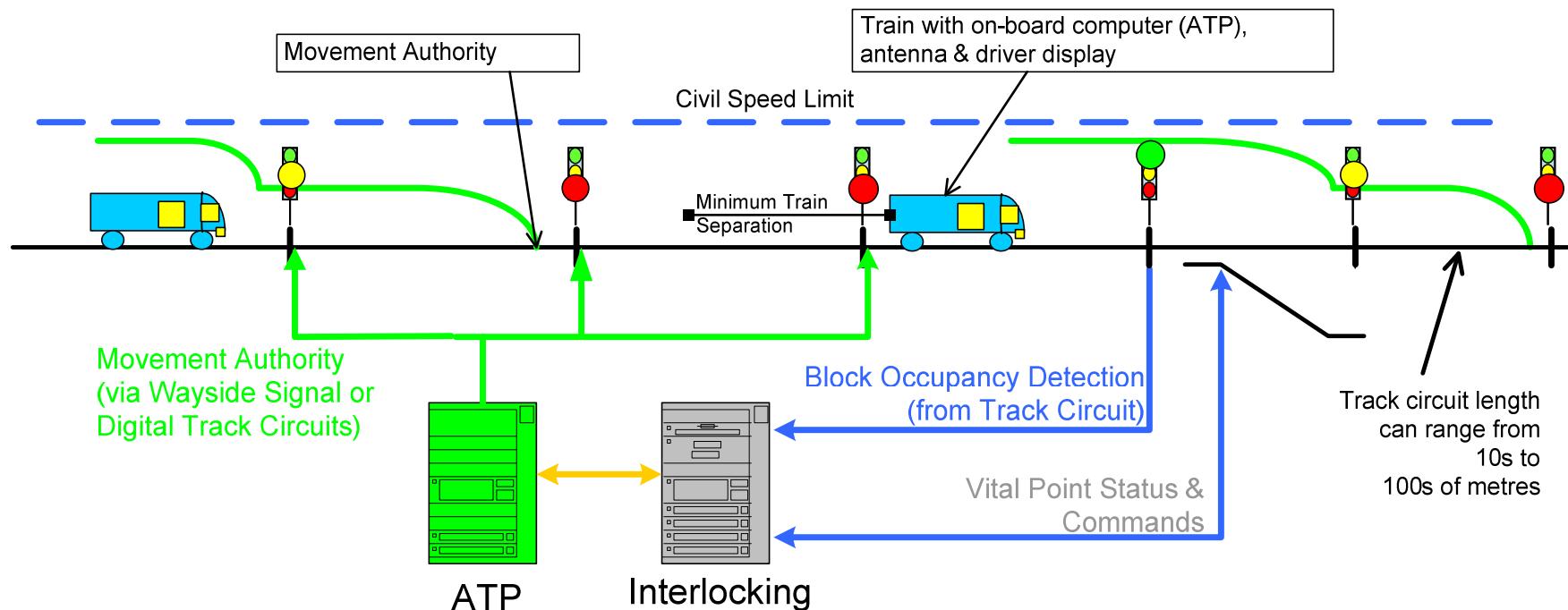


- A operação é baseada na distância de frenagem determinada pelas características do e as condições operacionais do momento (velocidade, rampa, condições meteorológicas, etc.)
- A distância de segurança do trem (“Block”) não está associada a segmentos / elementos fixos, na via (circ de via)
- A distância de segurança é calculada a cada momento, tendo em conta os elementos acima mencionados
- Total harmonia entre o movimento dos trens e as necessidades operacionais

Sinalização com Bloco Fixo



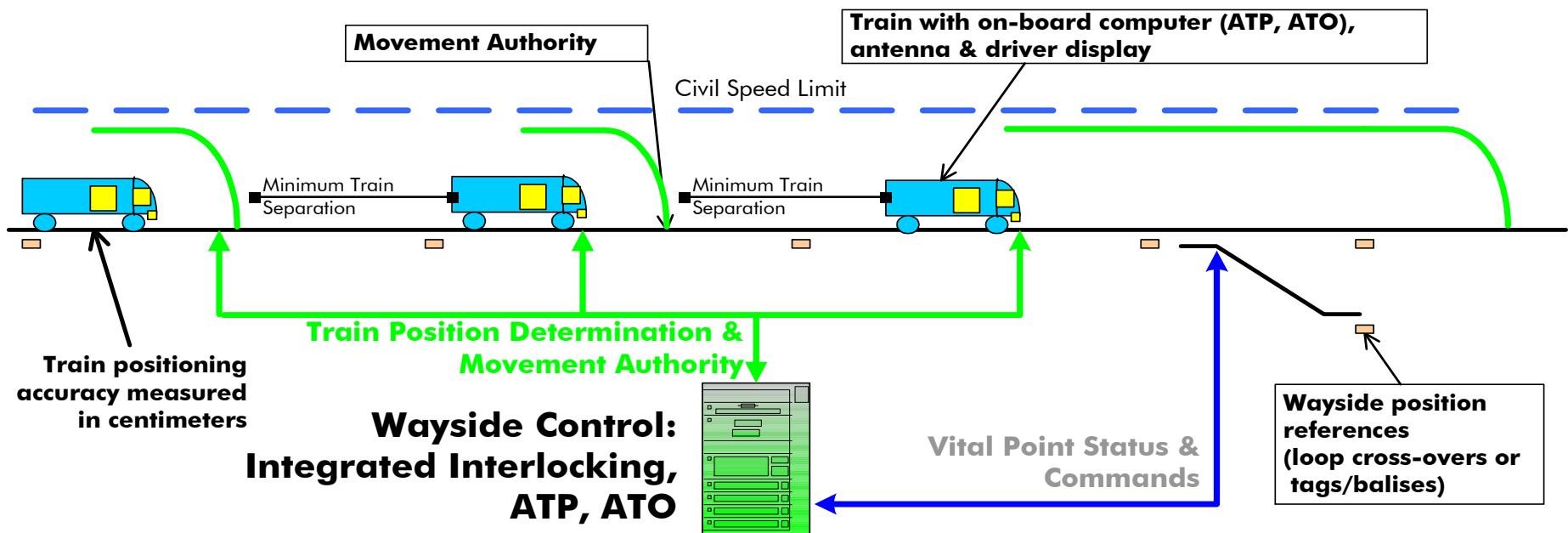
- Operação está limitada e restrita ao projeto, não podendo se adaptar às necessidades e variações horárias e diárias
 - A comunicação é em um sentido – da via ao trem (one-way)
 - A capacidade está limitada pelos blocos que são projetados para o trem de pior desempenho (pior curva de frenagem)
 - O trem seguinte não pode entrar num bloco antes que o mesmo esteja liberado pelo trem que vai à frente



Sinalização com Bloco Móvel - CBTC



- Computadores de bordo controlam o trem, em tempo real através de comunicação bi-direcional contínua
 - O desempenho é determinado pelas características de cada trem, em cada momento, tirando proveito máximo da infraestrutura e do material rodante



ATC - Hierarquia (IEC 62290-1)



STO Semi-automated Train Operation

Piloto na cabine

Controla a partida e atua em caso de incidentes

Possui estratégia de recuperação de falhas

DTO Driverless Train Operation

Staff on board

UTO Unmanned Train Operation



Hong Kong



London



Ankara



Guangzhou



STO Semi-automated Train Operation

Driver in the cabin

Departure control, guideway hazards

Failure recovery strategies



DTO Driverless Train Operation

Staff a bordo (não conduz o trem)

UTO Unmanned Train Operation



San Francisco



London DLR



STO Semi-automated Train Operation

Driver in the cabin

Departure control, guideway hazards

Failure recovery strategies

DTO Driverless Train Operation

Staff on board

UTO Unmanned Train Operation



Vancouver



Kuala Lumpur



Dubai



Las Vegas



New York JFK



Hong Kong DRL

THALES

Aplicação de CBTC no Mundo



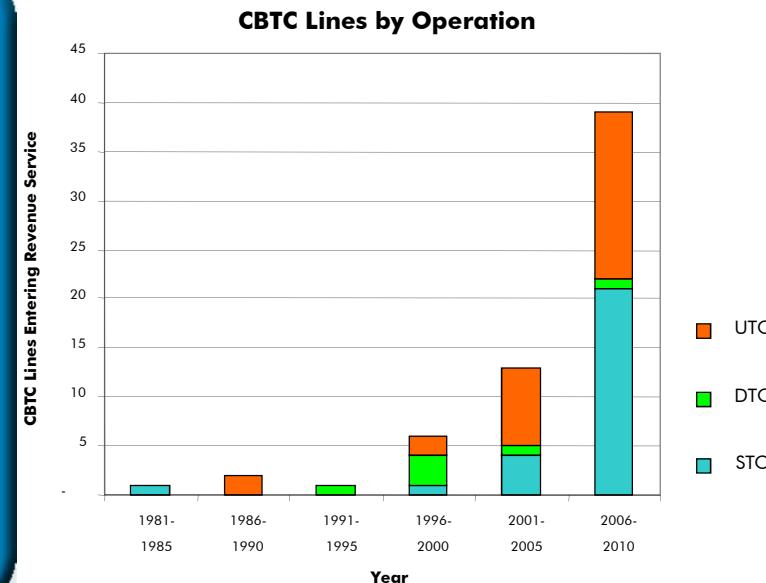
Renovação de Linhas

24% selecionam a tecnologia CBTC
driverless

Novas Linhas (~100% selecionam
CBTC)

33% selecionam STO e

67% selecionam DTO ou UTO



Novos operadores preferem a tecnologia “driverless”

Operadores tradicionais estão migrando para a tecnologia
“driverless”

Business Case – Otimização da Infraestrutura



Capital Cost

Operating Cost

Capacity

Flexibility

Availability



Plataformas mais curtas (estações menores) com trens mais frequentes e mais curtos

- MTR West Rail economizou \$384 milhões USD, numa linha com 9 estações

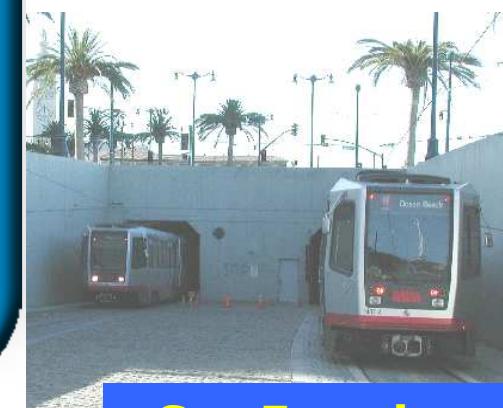


Melhor aproveitamento da via existente evitando a construção de um novo túnel

- San Francisco MUNI não teve que construir um novo túnel, pois com a instalação do CBTC aumentou a capacidade do existente de 23 para 48 trens p/ hora, economizando 1.3 bilhões USD



Hong Kong



San Francisco

Business Case – Otimização de Equipamento



Capital Cost

Operating
Cost

Capacity

Flexibility

Availability



- Devido à confiabilidade intrínseca, o CBTC não necessita de sistema de reserva ("fallback")
- Menos equipamento ao longo da via devido a funções integradas



Business Case – Adaptabilidade à Expansão



Capital Cost

Operating
Cost

Capacity

Flexibility

Availability



Uma vez instalado, o CBTC permite a redução do intervalo entre trens até 90 segundos, sem necessidade de instalação de equipamento de campo adicional

- Kuala Lumpur PUTRA e Vancouver SkyTrain aumentaram a sua frota sem necessidade de investir em HW e SW do sistema de Sinalização



A expansão do sistema não está atrelada ao tipo de trem

- CBTC permite a operação simultânea de diferentes tipos de trens sobre a mesma linha. Vancouver SkyTrain opera 2 gerações diferentes de trens e San Francisco MUNI, 3 gerações diferentes

Business Case – Aumento da Capacidade



Capital Cost

Operating Cost

Capacity

Flexibility

Availability

Sistemas antigos podem ser modernizados sem necessidade de suspender a operação, aumentando a sua capacidade, através da implantação de CBTC

- San Francisco MUNI
- London Underground é um dos maiores e mais antigos metrôs do mundo. Thales SelTrac CBTC está sendo implantado através do maior contrato de Re-Sinalização do mundo:
 - Jubilee (2009): 35 km, 63 trens
 - Northern (2011): 57 km, 106 trens
 - Piccadilly (2015): 71 km, 92 trens
- 20% de aumento de capacidade
- Mínimo impacto na operação durante a instalação



Business Case – Economia de Energia



Capital Cost

Operating
Cost

Capacity

Flexibility

Availability



Perfis de operação direcionados à economia de energia e adaptados aos horários (pico, vale) e dias da semana



Sincronização de partidas e chegadas de forma a otimizar o consumo de energia

Hong Kong economiza 2 Milhões USD por ano graças à instalação do sistema CBTC - UTO

Vancouver SkyTrain: “O consumo de energia por passageiro.km é cerca da metade da média encontrada em outros sistemas similares, sem CBTC.”
“BC Transit Fact Sheet – SkyTrain Performance”, October 1991

Business Case – Flexibilidade Operacional



Capital Cost

Operating Cost

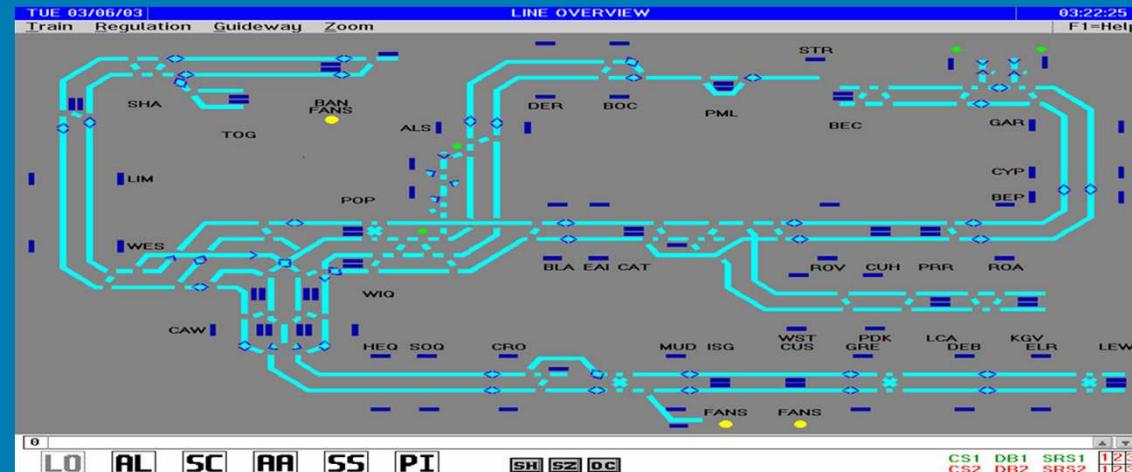
Capacity

Flexibility

Availability



Gerenciamento automático de cruzamentos



London DLR



Recuperação assistida de incidentes

- Operação Bi-direcional, na mesma via
- Recuperação automática de desvios da programação diária

Business Case – Pátio tipo Driverless



Capital Cost

Operating Cost

Capacity

Flexibility

Availability

Roteamento automático

Modo estacionamento com reinício automático

➤ **Preparação da frota em modo automático**

➤ **Minimização de deslocamentos no pátio**

➤ **Operação automatizada de acoplamento e desacoplamento de trens**

➤ **Economia de Can\$ 1 milhão por ano, devido à automatização do pátio Sky Train Vancouver**

Operação automática de lavagem



Kuala Lumpur

CBTC - Passageiros por Empregado



Passageiros por empregado

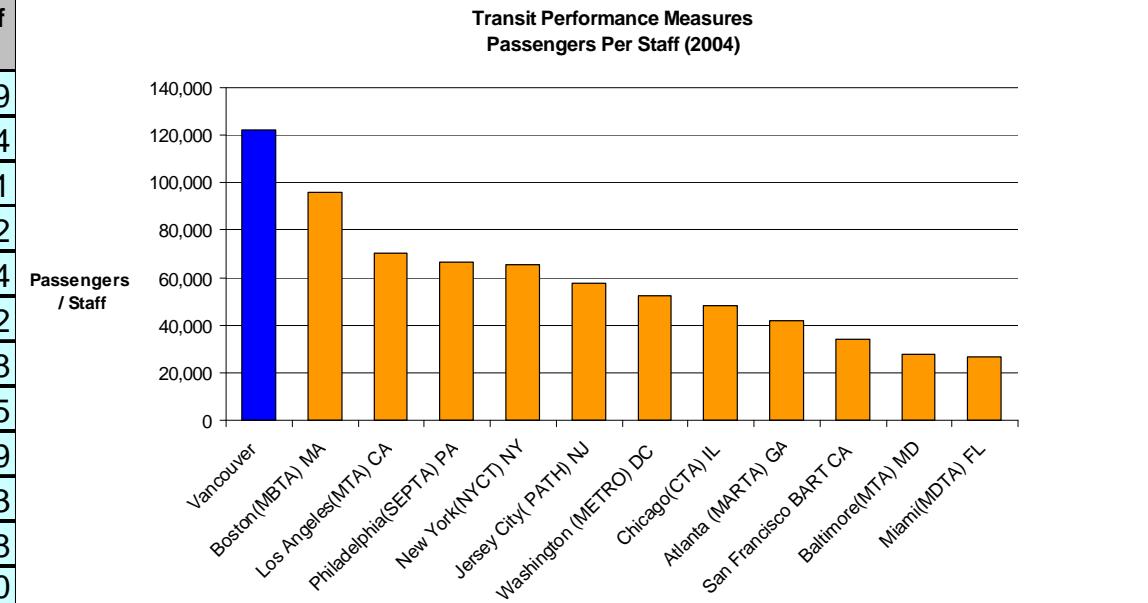
Fonte: APTA

Azul: SelTrac CBTC



Comparação de sistemas similares: Vancouver (com CBTC) é 28% mais eficiente que Boston (sem CBTC), o que representa uma economia anual de US\$ 15 milhões

Rank	Transit Authority	Passengers per Staff
1	Vancouver	121,957.29
2	Boston(MBTA) MA	95,804.44
3	Los Angeles(MTA) CA	70,000.91
4	Philadelphia(SEPTA) PA	66,528.02
5	New York(NYCT) NY	65,289.24
6	Jersey City(PATH) NJ	57,441.02
7	Washington(METRO) DC	52,395.48
8	Chicago(CTA) IL	48,197.55
9	Atlanta(MARTA) GA	41,821.19
10	San Francisco BART CA	34,298.73
11	Baltimore(MTA) MD	28,048.98
12	Miami(MDTA) FL	26,914.80



CBTC - Custo Operacional por Passageiro



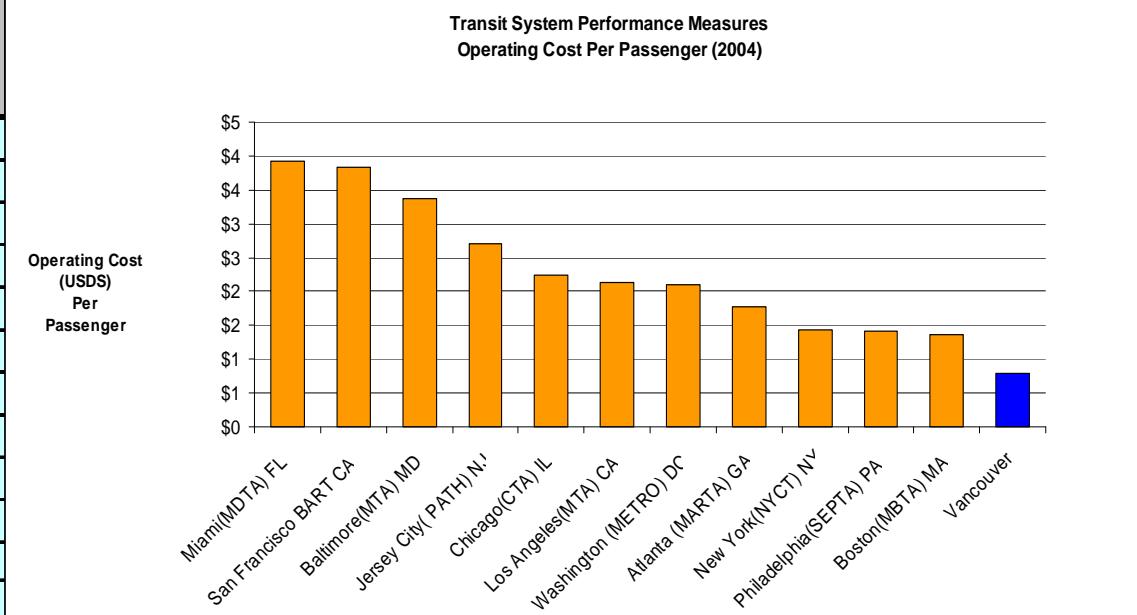
Custo Operacional por Passageiro

Fonte: APTA

Azul: SelTrac CBTC

Comparação de sistemas similares: Vancouver (com CBTC) é 42% mais barato que Boston (sem CBTC), o que representa uma economia anual de US\$ 60 milhões

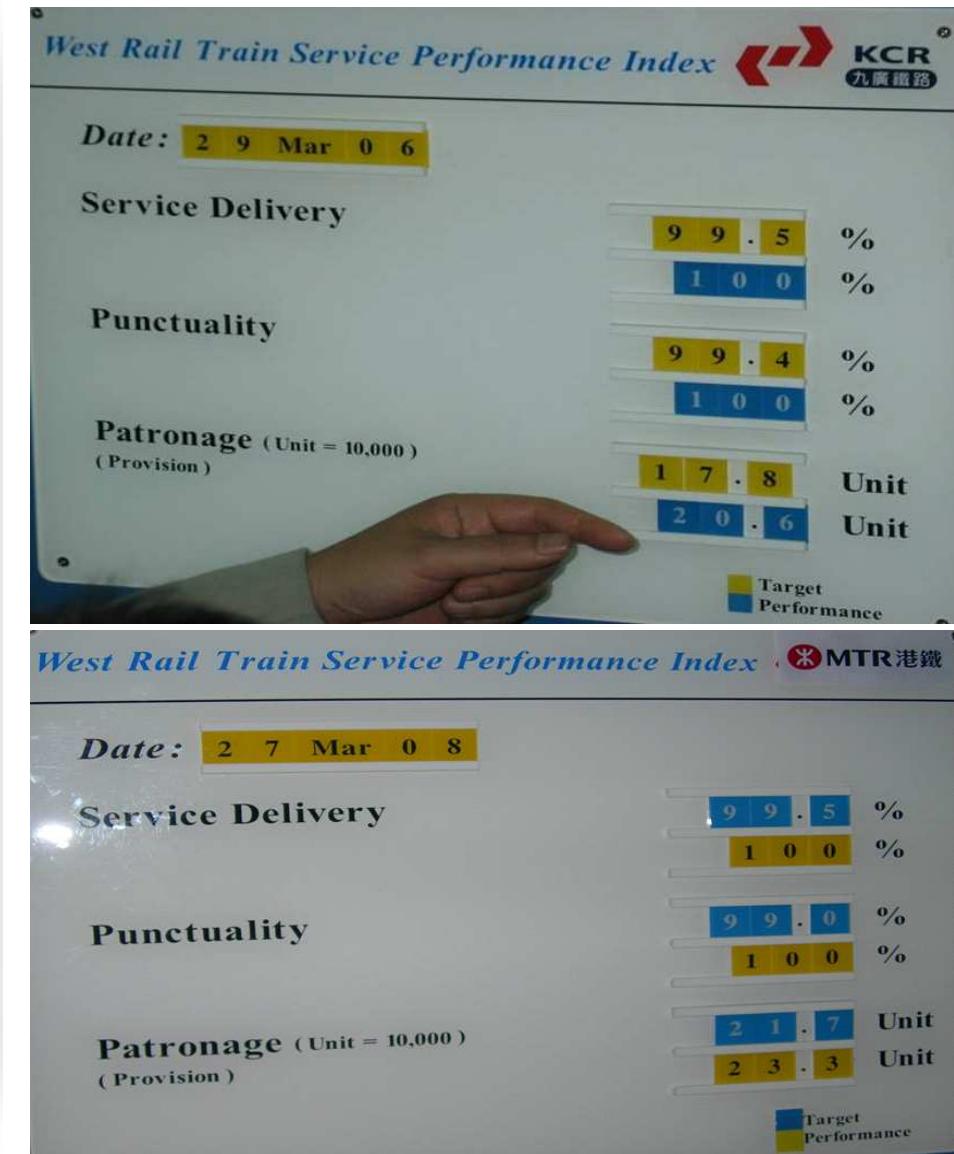
Rank	Transit Authority	Operating cost per Passenger
1	Miami(MDTA) FL	\$ 3.93
2	San Francisco BART CA	\$ 3.84
3	Baltimore(MTA) MD	\$ 3.36
4	Jersey City(PATH) NJ	\$ 2.70
5	Chicago(CTA) IL	\$ 2.24
6	Los Angeles(MTA) CA	\$ 2.13
7	Washington (METRO) DC	\$ 2.10
8	Atlanta (MARTA) GA	\$ 1.78
9	New York(NYCT) NY	\$ 1.44
10	Philadelphia(SEPTA) PA	\$ 1.42
11	Boston(MBTA) MA	\$ 1.36
12	Vancouver	\$ 0.79



Case Study: CBTC Disponibilidade



- Tecnologia “Fault Tolerant”
- Redundância
- 2x2oo2 ou 2oo3 para equipamentos de campo e embarcados
- Auto-Restart



CBTC Thales - Uma história de sucesso operacional



Uma experiência de mais de 25 anos

- 1º CBTC em operação comercial (Vancouver, 1986)
- 1º sistema de comunicações, para controle de trens em standard aberto (Las Vegas, 2004)



Thales SelTrac CBTC é uma solução provada e voltada ao futuro

- 1.090 km de SelTrac CBTC contratados
- 4.128 km.ano de SelTrac CBTC em operação
- Recordista na implantação de sistemas
 - 12 colocações ao serviço em 2009
 - 11 colocações ao serviço em 2010



CBTC Blocos Móveis), da Thales oferece

- **Economia de infraestrutura**
- **Fácil expansão da linha e da frota**
- **Menores custos de operação e manutenção**
- **Economia de energia**
- **Flexibilidade operacional**
- **Alta confiabilidade e disponibilidade**
- **Excelentes referências, no tocante à segurança**

CBTC Thales - Conclusões



- CBTC representa a oportunidade de aumentar o desempenho e a segurança, com melhores custos totais de ciclo de vida
- Driverless CBTC vai de encontro às necessidades de aumentar a capacidade de transporte e reduzir os custos totais de forma eficiente e segura
- CBTC é mais que uma tendência, sendo já uma preferência mundial em tecnologia de sinalização, para sistemas urbanos sobre trilhos/guiados



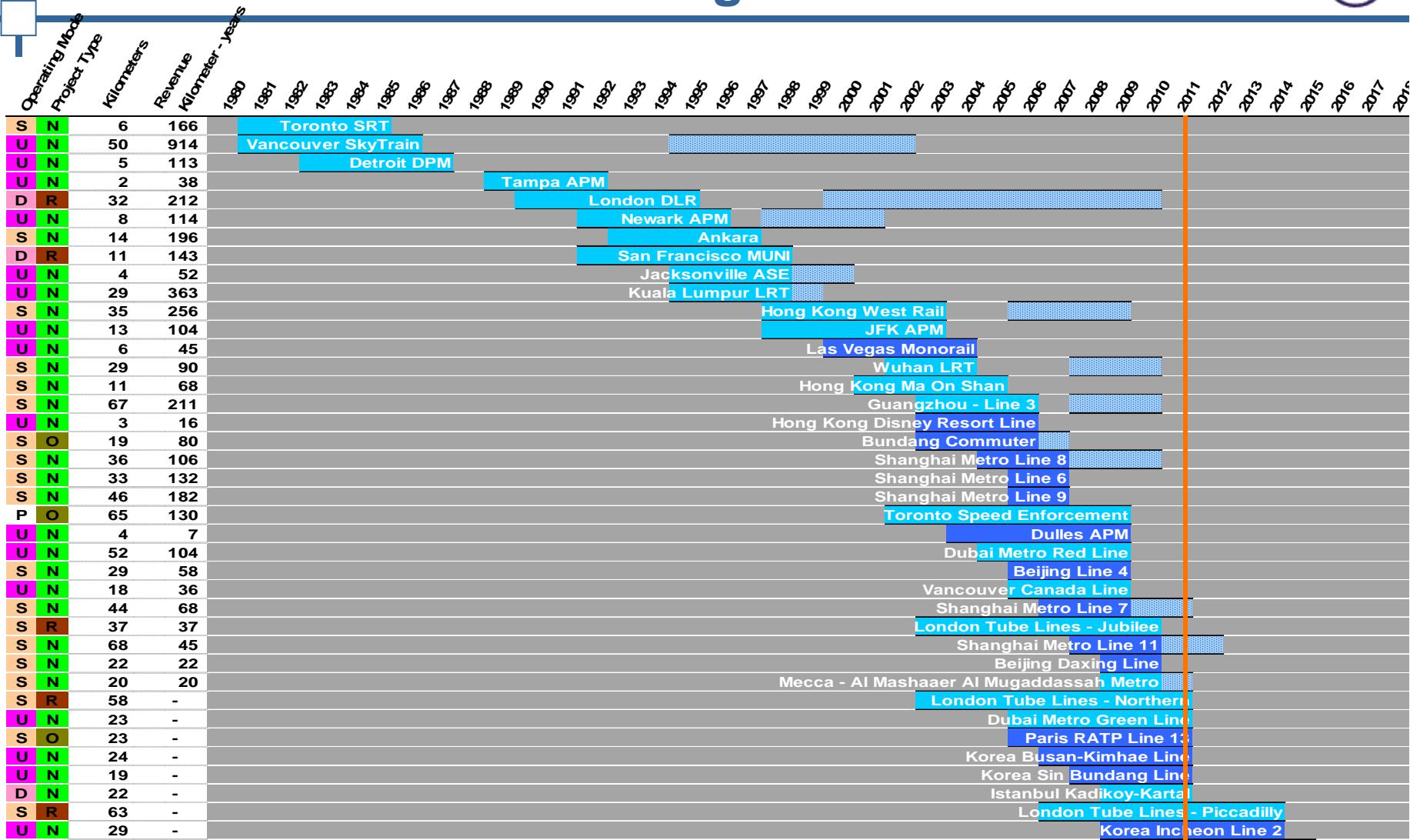
CBTC Thales - Conclusões



CBTC Thales, presente nos mais importantes sistemas urbanos do mundo

- Shanghai – a maior rede, em km
- Nova York – a maior rede, em estações
- Londres – a 2^a maior e o mais complexo
- Dubai – o mais avançado
- Hong Kong – entre os mais modernos
- Cingapura – entre os 5 maiores e mais eficientes
- Paris – entre os 5 maiores e mais eficientes
- Pequim, Cantão, Kuala Lumpur, San Francisco, Toronto, Vancouver,

Thales e CBTC – Uma longa História de Sucesso



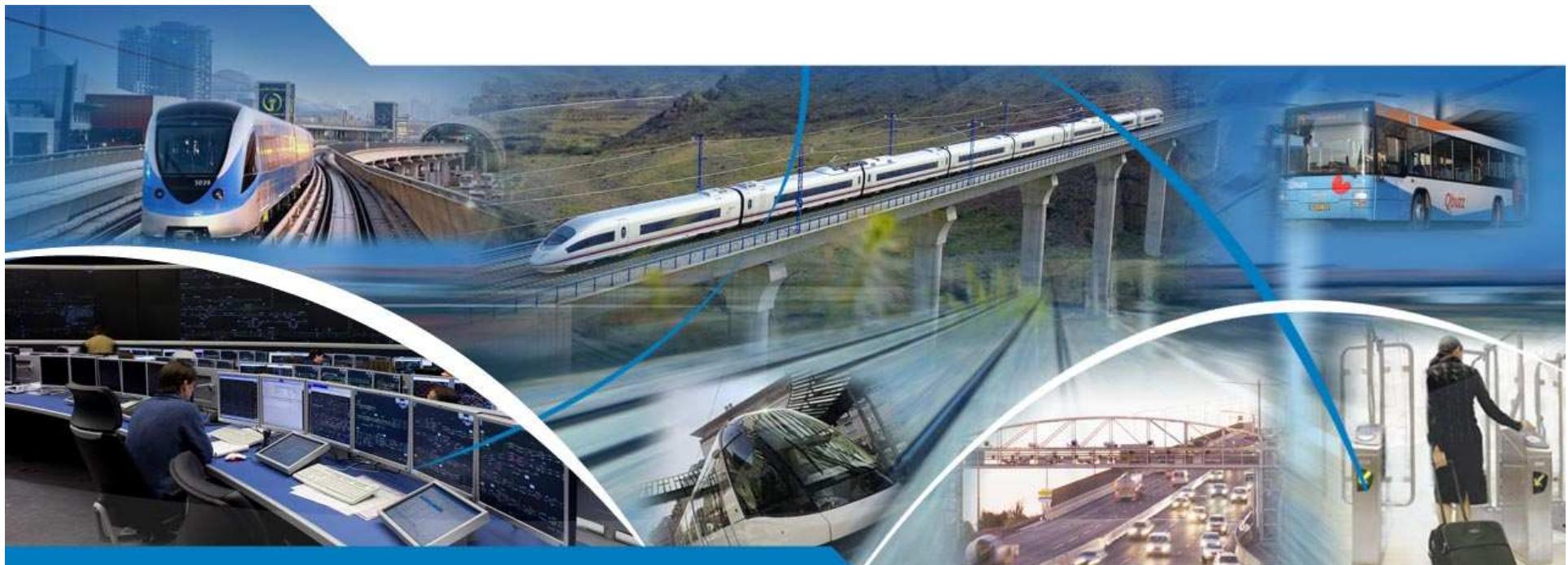
1 090 4 128 Revenue km-years as of end-of 2011

Operating Mode		
Manual Driving with Automatic Train Protection	ATP	1
Automatic Operation with Attendant in the Cab	STO	20
Automatic Operation with Attendant on-board	DTO	3
Automatic Operation without a Driver	UTO	16

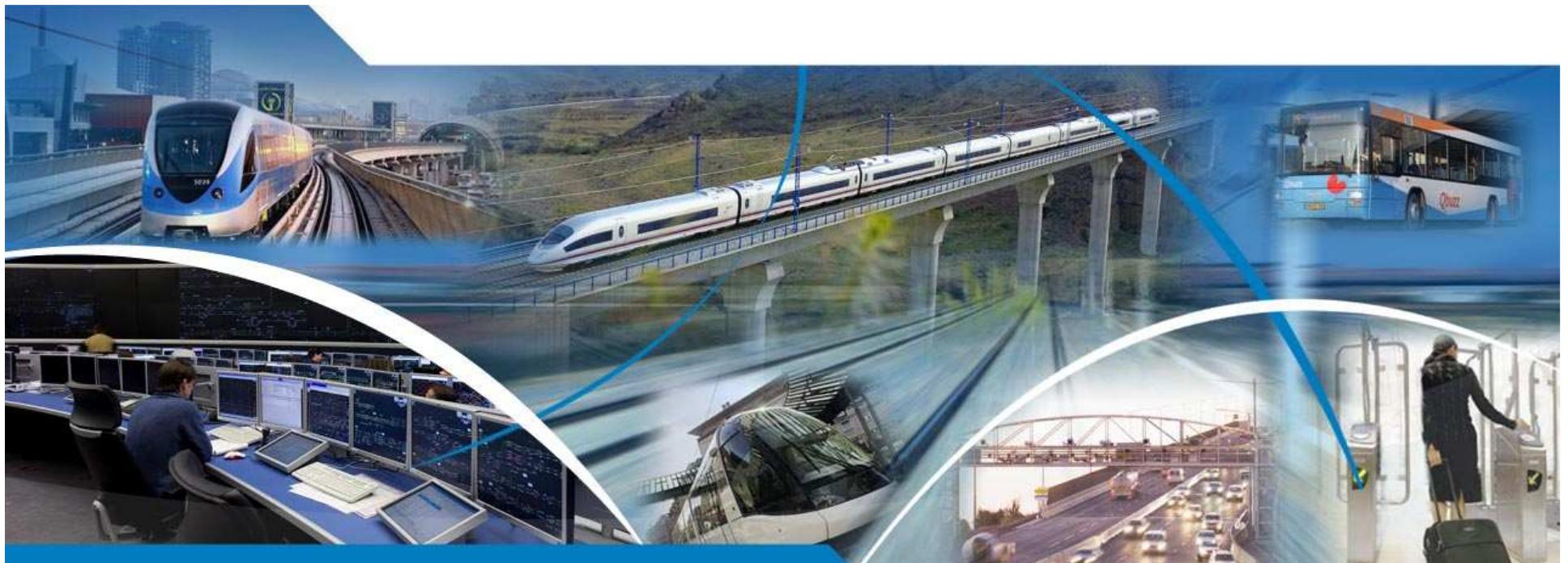
Project Type	
New	31
Resignal	6
Overlay	3

Comms	
Loop	23
Radio	16
Tag	1

Initial System Extension(s)



➔ Muito Obrigado
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➔ **Thales CBTC SelTrac
Projetos: “Case Studies”**

Case study: Al Mashaer Al Mugadasah Metro Mecca, Saudi Arabia



Customer challenges

- Improve transit in and around Mecca to facilitate the mobility of 2 million people who participate in the annual Hajj pilgrimage to Mecca.
- Build a driverless 20km Metro Line.



Thales answer

- Turnkey Thales solution including signalling (SelTrac CBTC solution), communications, operation control centre, CCTV, SCADA, automatic address and information system.



Main benefits

- High capacity for service frequency and efficiency
- Complete integrated solution to optimize operation
- Moving-block technology for minimum headways with safe Operation.
- Reduced life-cycle cost



Key dates:

- Awarded in June 2009
- Revenue service 1st stage Nov 2010

Case study: Al Mashaer Al Mugadasah Metro Mecca, Saudi Arabia



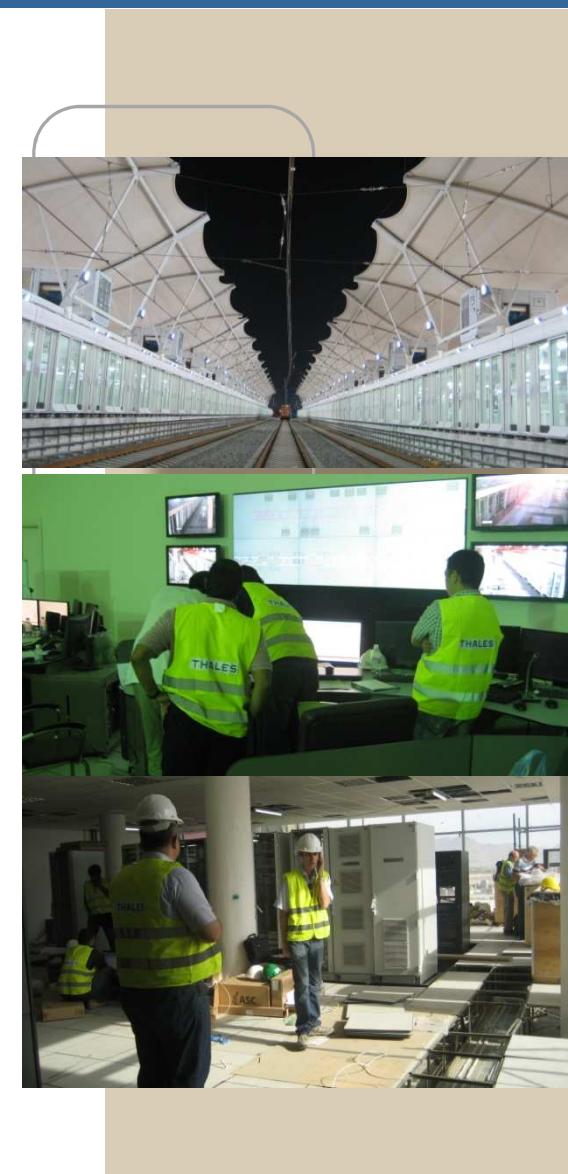
Project delivery challenges

- Schedule, with hard deadline HAJJ 2010
- Lack of local signalling expertise
- Site accessibility restrictions
- Multicultural environment
- Ensure flawless HAJJ 2010 revenue service from day one



Thales answer

- Flexibility to adapt to construction deliveries dynamically allocating shifts and resources
- Train people well in advance to create experts and overcome site accessibility restrictions
- One team approach Customer, end Customer, consultants and Safety Assessor
- Strong continuous communication to address the multicultural environment
- Resident emergency response team during Hajj



Case study: Al Mashaer Al Mugadasah Metro Mecca, Saudi Arabia



Thales Achievements

- Successful delivery on time for Hajj
- Successful operation during Hajj 2010
- CUSTOMER SATISFACTION



IN THE NAME OF ALLAH, MOST GRACEFUL MOST MERCIFUL

KINGDOM OF SAUDI ARABIA
MINISTRY OF WORKS
CENTRAL DIRECTORATE FOR PROJECT DEVELOPMENT
MASHAER RAIL PROJECT

186/A
DATE: 29/11/1431 HIGRI

Dear respected Thales Company

Peace and Allah's blessing upon you

We would like to thank you on your efforts in the execution of your assigned tasks represented in the Singalling and Communitaion of the Mashaer religious rail project – South line.

We sincerely appreciate your effort and the continuous work around the clock to complete the necessary work required for this year operation. Hoping that this effort will continue until the completion of all necessary required tasks to operate the project 100%, God's willing.

Please accept our best regards

Dr. Eng. Habib Zein-Alabideen

First Deputy Minister

Central Directorate for Project Development
Ministry of Works - Saudi Arabia



30-day test run for Makkah Metro

Trains will transport 72,000 pilgrims in an hour

P.X. ABDUL GHAFOUR | AFP/GETTY IMAGES
MECCA, SAUDI ARABIA: The newly established Makkah Rail, which links the holy sites of Mecca and Medina, has started operating after the \$18.5 billion high-speed Jeddah-Zein Al-Abidine railway was completed.

Habib Zein Al-Abidine, director of metropolitan and rural affairs, said the train will connect the two cities via a prime artery of the Kingdom.

Municipal and Rural Affairs Minister Dr. Hamed Bin Mohsin Zain Al-Abidine, also known as the Makkah minister, told reporters on Thursday to make sure the facility is ready for the Hajj season.

The railway will bring about a dramatic change in pilgrim transportation between the two cities.

Established at a cost of \$18.5 billion, the railway will connect the two cities via a prime artery of the Kingdom.

The railway will have a total length of 400 km each before starting regular services on October 1, he said.

The first stage of the project will be completed in three months, he said.

The second stage will be completed in six months, he said.

The third stage will be completed in nine months, he said.

The fourth stage will be completed in 12 months, he said.

The fifth stage will be completed in 18 months, he said.

The sixth stage will be completed in 24 months, he said.

The seventh stage will be completed in 30 months, he said.

The eighth stage will be completed in 36 months, he said.

The ninth stage will be completed in 42 months, he said.

The tenth stage will be completed in 48 months, he said.

The eleventh stage will be completed in 54 months, he said.

The twelfth stage will be completed in 60 months, he said.

The thirteenth stage will be completed in 66 months, he said.

The fourteenth stage will be completed in 72 months, he said.

The fifteenth stage will be completed in 78 months, he said.

The sixteenth stage will be completed in 84 months, he said.

The seventeenth stage will be completed in 90 months, he said.

The eighteenth stage will be completed in 96 months, he said.

The nineteenth stage will be completed in 102 months, he said.

The twentieth stage will be completed in 108 months, he said.

The twenty-first stage will be completed in 114 months, he said.

The twenty-second stage will be completed in 120 months, he said.

The twenty-third stage will be completed in 126 months, he said.

The twenty-fourth stage will be completed in 132 months, he said.

The twenty-fifth stage will be completed in 138 months, he said.

The twenty-sixth stage will be completed in 144 months, he said.

The twenty-seventh stage will be completed in 150 months, he said.

The twenty-eighth stage will be completed in 156 months, he said.

The twenty-ninth stage will be completed in 162 months, he said.

The thirtieth stage will be completed in 168 months, he said.

The thirty-first stage will be completed in 174 months, he said.

The thirty-second stage will be completed in 180 months, he said.

The thirty-third stage will be completed in 186 months, he said.

The thirty-fourth stage will be completed in 192 months, he said.

The thirty-fifth stage will be completed in 198 months, he said.

The thirty-sixth stage will be completed in 204 months, he said.

The thirty-seventh stage will be completed in 210 months, he said.

The thirty-eighth stage will be completed in 216 months, he said.

The thirty-ninth stage will be completed in 222 months, he said.

The forty stage will be completed in 228 months, he said.

The forty-one stage will be completed in 234 months, he said.

The forty-two stage will be completed in 240 months, he said.

The forty-three stage will be completed in 246 months, he said.

The forty-four stage will be completed in 252 months, he said.

The forty-five stage will be completed in 258 months, he said.

The forty-six stage will be completed in 264 months, he said.

The forty-seven stage will be completed in 270 months, he said.

The forty-eight stage will be completed in 276 months, he said.

The forty-nine stage will be completed in 282 months, he said.

The fifty stage will be completed in 288 months, he said.

The fifty-one stage will be completed in 294 months, he said.

The fifty-two stage will be completed in 300 months, he said.

The fifty-three stage will be completed in 306 months, he said.

The fifty-four stage will be completed in 312 months, he said.

The fifty-five stage will be completed in 318 months, he said.

The fifty-six stage will be completed in 324 months, he said.

The fifty-seven stage will be completed in 330 months, he said.

The fifty-eight stage will be completed in 336 months, he said.

The fifty-nine stage will be completed in 342 months, he said.

The sixty stage will be completed in 348 months, he said.

The sixty-one stage will be completed in 354 months, he said.

The sixty-two stage will be completed in 360 months, he said.

The sixty-three stage will be completed in 366 months, he said.

The sixty-four stage will be completed in 372 months, he said.

The sixty-five stage will be completed in 378 months, he said.

The sixty-six stage will be completed in 384 months, he said.

The sixty-seven stage will be completed in 390 months, he said.

The sixty-eight stage will be completed in 396 months, he said.

The sixty-nine stage will be completed in 402 months, he said.

The七十 stage will be completed in 408 months, he said.

The seventy-one stage will be completed in 414 months, he said.

The seventy-two stage will be completed in 420 months, he said.

The seventy-three stage will be completed in 426 months, he said.

The seventy-four stage will be completed in 432 months, he said.

The seventy-five stage will be completed in 438 months, he said.

The seventy-six stage will be completed in 444 months, he said.

The seventy-seven stage will be completed in 450 months, he said.

The seventy-eight stage will be completed in 456 months, he said.

The seventy-nine stage will be completed in 462 months, he said.

The eighty stage will be completed in 468 months, he said.

The eighty-one stage will be completed in 474 months, he said.

The eighty-two stage will be completed in 480 months, he said.

The eighty-three stage will be completed in 486 months, he said.

The eighty-four stage will be completed in 492 months, he said.

The eighty-five stage will be completed in 498 months, he said.

The eighty-six stage will be completed in 504 months, he said.

The eighty-seven stage will be completed in 510 months, he said.

The eighty-eight stage will be completed in 516 months, he said.

The eighty-nine stage will be completed in 522 months, he said.

The ninety stage will be completed in 528 months, he said.

The ninety-one stage will be completed in 534 months, he said.

The ninety-two stage will be completed in 540 months, he said.

The ninety-three stage will be completed in 546 months, he said.

The ninety-four stage will be completed in 552 months, he said.

The ninety-five stage will be completed in 558 months, he said.

The ninety-six stage will be completed in 564 months, he said.

The ninety-seven stage will be completed in 570 months, he said.

The ninety-eight stage will be completed in 576 months, he said.

The ninety-nine stage will be completed in 582 months, he said.

The一百 stage will be completed in 588 months, he said.

The一百一 stage will be completed in 594 months, he said.

The一百二 stage will be completed in 600 months, he said.

The一百三 stage will be completed in 606 months, he said.

The一百四 stage will be completed in 612 months, he said.

The一百五 stage will be completed in 618 months, he said.

The一百六 stage will be completed in 624 months, he said.

The一百七 stage will be completed in 630 months, he said.

The一百八 stage will be completed in 636 months, he said.

The一百九 stage will be completed in 642 months, he said.

The一百十 stage will be completed in 648 months, he said.

The一百十一 stage will be completed in 654 months, he said.

The一百十二 stage will be completed in 660 months, he said.

The一百十三 stage will be completed in 666 months, he said.

The一百十四 stage will be completed in 672 months, he said.

The一百十五 stage will be completed in 678 months, he said.

The一百十六 stage will be completed in 684 months, he said.

The一百十七 stage will be completed in 690 months, he said.

The一百十八 stage will be completed in 696 months, he said.

The一百十九 stage will be completed in 702 months, he said.

The一百二十 stage will be completed in 708 months, he said.

The一百二十一 stage will be completed in 714 months, he said.

The一百二十二 stage will be completed in 720 months, he said.

The一百二十三 stage will be completed in 726 months, he said.

The一百二十四 stage will be completed in 732 months, he said.

The一百二十五 stage will be completed in 738 months, he said.

The一百二十六 stage will be completed in 744 months, he said.

The一百二十七 stage will be completed in 750 months, he said.

The一百二十八 stage will be completed in 756 months, he said.

The一百二十九 stage will be completed in 762 months, he said.

The一百三十 stage will be completed in 768 months, he said.

The一百三十一 stage will be completed in 774 months, he said.

The一百三十二 stage will be completed in 780 months, he said.

The一百三十三 stage will be completed in 786 months, he said.

The一百三十四 stage will be completed in 792 months, he said.

The一百三十五 stage will be completed in 798 months, he said.

The一百三十六 stage will be completed in 804 months, he said.

The一百三十七 stage will be completed in 810 months, he said.

The一百三十八 stage will be completed in 816 months, he said.

The一百三十九 stage will be completed in 822 months, he said.

The一百四十 stage will be completed in 828 months, he said.

The一百四十一 stage will be completed in 834 months, he said.

The一百四十二 stage will be completed in 840 months, he said.

The一百四十三 stage will be completed in 846 months, he said.

The一百四十四 stage will be completed in 852 months, he said.

The一百四十五 stage will be completed in 858 months, he said.

The一百四十六 stage will be completed in 864 months, he said.

The一百四十七 stage will be completed in 870 months, he said.

The一百四十八 stage will be completed in 876 months, he said.

The一百四十九 stage will be completed in 882 months, he said.

The一百五十 stage will be completed in 888 months, he said.

The一百五十一 stage will be completed in 894 months, he said.

The一百五十二 stage will be completed in 900 months, he said.

The一百五十三 stage will be completed in 906 months, he said.

The一百五十四 stage will be completed in 912 months, he said.

The一百五十五 stage will be completed in 918 months, he said.

The一百五十六 stage will be completed in 924 months, he said.

The一百五十七 stage will be completed in 930 months, he said.

The一百五十八 stage will be completed in 936 months, he said.

The一百五十九 stage will be completed in 942 months, he said.

The一百六十 stage will be completed in 948 months, he said.

The一百六十ー stage will be completed in 954 months, he said.

The一百六十ーー stage will be completed in 960 months, he said.

The一百六十ーーー stage will be completed in 966 months, he said.

The一百六十ーーーー stage will be completed in 972 months, he said.

The一百六十ーーーーー stage will be completed in 978 months, he said.

The一百六十ーーーーーー stage will be completed in 984 months, he said.

The一百六十ーーーーーーー stage will be completed in 990 months, he said.

The一百六十ーーーーーーーー stage will be completed in 996 months, he said.

The一百六十ーーーーーーーーー stage will be completed in 1,002 months, he said.

The一百六十ーーーーーーーーーー stage will be completed in 1,008 months, he said.

The一百六十ーーーーーーーーーーー stage will be completed in 1,014 months, he said.

The一百六十ーーーーーーーーーーーー stage will be completed in 1,020 months, he said.

The一百六十ーーーーーーーーーーーーー stage will be completed in 1,026 months, he said.

The一百六十ーーーーーーーーーーーーーー stage will be completed in 1,032 months, he said.

The一百六十ーーーーーーーーーーーーーーー stage will be completed in 1,038 months, he said.

The一百六十ーーーーーーーーーーーーーーーー stage will be completed in 1,044 months, he said.

The一百六十ーーーーーーーーーーーーーーーーー stage will be completed in 1,050 months, he said.

The一百六十ーーーーーーーーーーーーーーーーーー stage will be completed in 1,056 months, he said.

The一百六十ーーーーーーーーーーーーーーーーーーー stage will be completed in 1,062 months, he said.

The一百六十ーーーーーーーーーーーーーーーーーーーー stage will be completed in 1,068 months, he said.

The一百六十ーーーーーーーーーーーーーーーーーーーーー stage will be completed in 1,074 months, he said.

The一百六十ーーーーーーーーーーーーーーーーーーーーーー stage will be completed in 1,080 months, he said.

The一百六十ーーーーーーーーーーーーーーーーーーーーーーー stage will be completed in 1,086 months, he said.

Case study: Dubai Red and Green Lines, UAE



Customer challenges

- With objectives of becoming the region's prime business and leisure destination, managing the mobility of a growing population, and reducing use of automobiles, the decision was made to build an efficient urban rail system using world-leading, proven advanced technology.



Thales answer

- SelTrac CBTC with moving-block technology proven for safe UTO operation.



Main benefits

- Proven in use for over 25 years.
- Close headways for shorter trains and optimal service frequency.
- Low operating and maintenance costs.
- Includes fully integrated communications solution.



Key dates:

- Awarded 2005
- Notice to proceed on Green Line 2007
- Revenue service September 9, 2009

Case study: Dubai Red and Green Lines, UAE

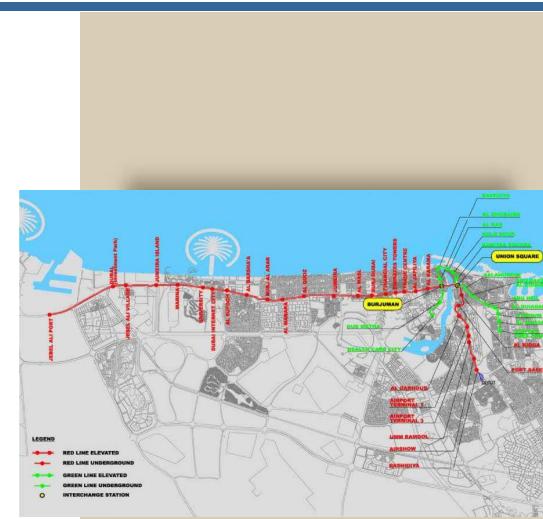


Project implementation challenges

- Schedule – end date 9-9-9
- Thales scope at the end of the chain
- System Integration
- International teaming
- Multicultural team from all over the world

Thales answer

- Strong risk management
- Flexibility, acknowledgement of the real project life, and adapt to it
- Early and proactive teaming approach with all stakeholders: direct customer, end customer, consultants, all subcontractors
- Strong interface definition and management within Thales and external subsystems



Scope:

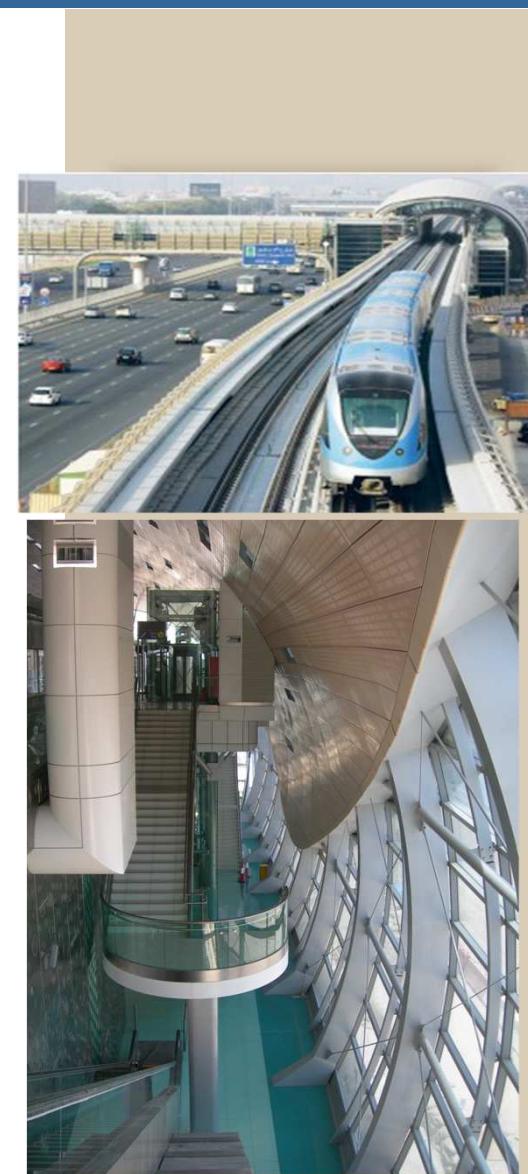
- Red Line
- 15,000 pphd, 52 km, 44 trains, 29 stations, Two depots
- Green Line
- 7,400 pphd, 23 km, 43 trains,
- 4 maintenance vehicles 20 stations, One depot

Case study: Dubai Red and Green Lines, UAE



The achievement

- Single largest fully automatic UTO system in the world (75kms).
- Opening on initial schedule “9-9-9” in full UTO with safety case for a railway where not all stations were initially opened
- CUSTOMER SATISFACTION
- Thales SelTrac operating reliably in an extreme desert climate (15minute deadline)



Case study: London Docklands LRT



Customer challenges

- Economic and building development in the Docklands area during the early 1990s created a significant increase in transit needs straining the existing system. The original train control system could not cope. 2012 Olympics on the horizon, improving the capacity and extension to link Olympic sites is a priority.



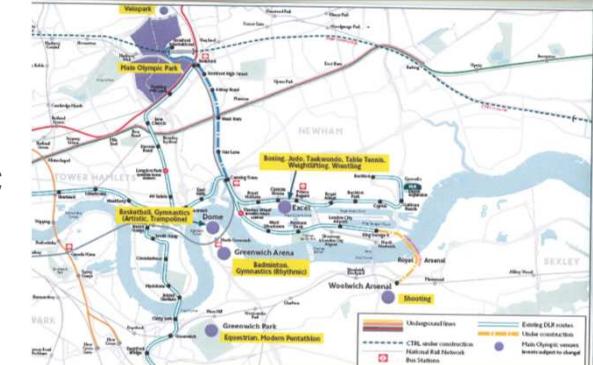
Thales answer

- SelTrac CBTC with moving-block technology.



Main benefits

- High, consistent reliability
- Proven easy to expand and commission
- By 2003, DLR accommodated 48 million passengers.



Key dates:

- Revenue service 1995
- Lewisham extension 1999
- City Airport extension 2005
- Woolwich extension 2008
- Stratford extension 2011

Case study: London Docklands LRT



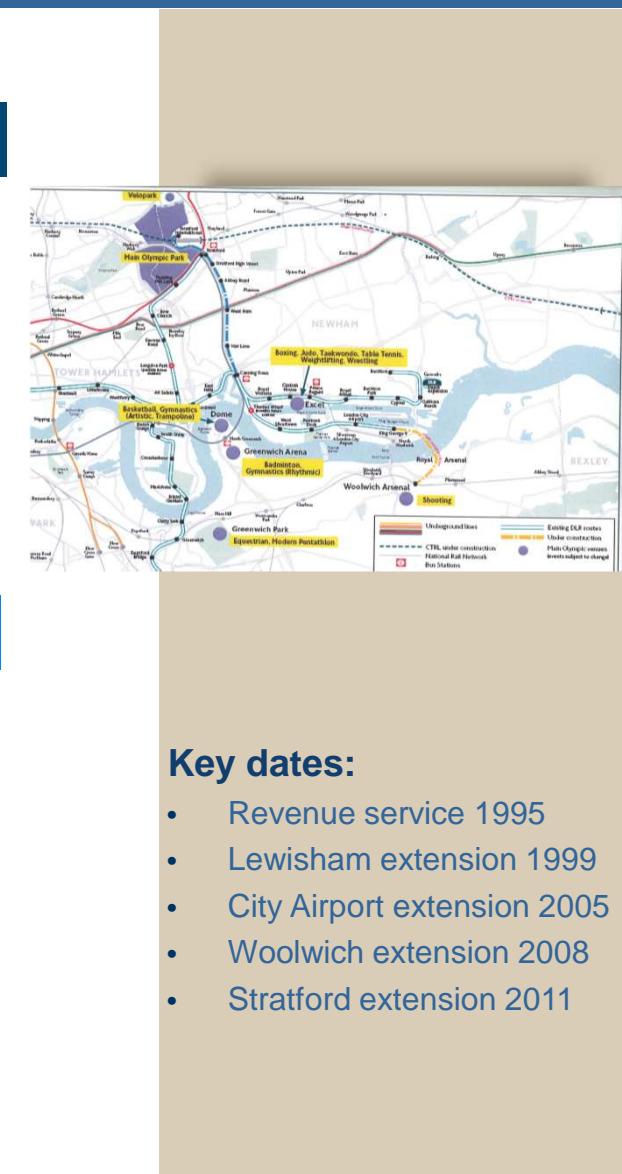
Projects delivery challenges

- Extremely complicated junctions to be modeled
- Stations platform extensions for 3 car trains
- Staged delivery of capacity increase
- Tight Schedule
- Backup Control Centre



Thales answer

- Detailed cutover and software releases plan
- Risk management plan
- One team approach with Customer, operator and other suppliers



Case study: London Docklands LRT



Thales achievements

- On time delivery for extensions
 - Lewisham extension 1999
 - City Airport extension 2005
 - Woolwich extension 2008
- Junctions redesign and fleet increase successful
- No disruption to revenue service
- On track to deliver Stratford



Key dates:

- Revenue service 1995
- Lewisham extension 1999
- City Airport extension 2005
- Woolwich extension 2008
- Stratford extension 2011

Case study: Shanghai Lines 6, 7, 8, 9, 11



Customer challenges

- Growth of the metro system network is deemed necessary to improve mobility of 17M citizens. The government's intent was to introduce the latest signalling technology and implement the "interoperability" on new lines. The three lines will need to enter into revenue service at the same time!



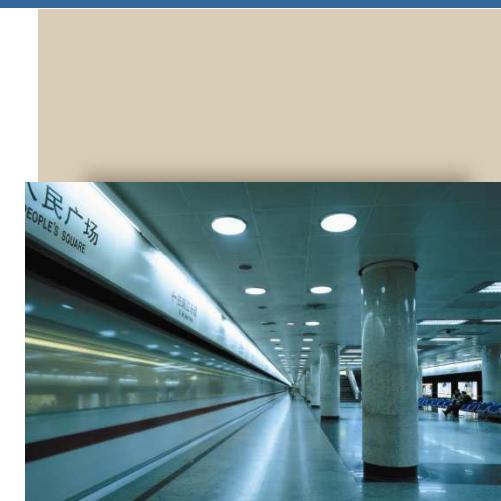
Thales answer

- SelTrac CBTC



Main benefits

- ATO for mixed train sets.
- Facilitates interoperability.
- Flexible, safe operation.
- Low life-cycle cost.



Key dates:

- Line 8 awarded 2005
- Line 6 awarded 2006
- Revenue service 2008

Case study: Shanghai Lines 6, 7, 8, 9, 11



Thales projects in Shanghai

Line	Line 8	Line 8x	Line 6	Line 9	Line 9x	Line 7	Line 11	TOTAL
Length	23km	10km	33km	32km	14km	34km	45km	191km
No. of Stations	21	9	28	13	10	28	21	130
No. of Trains	28	18	32	16	28	42	58	222



Case study: Shanghai Lines 6, 8 and 9



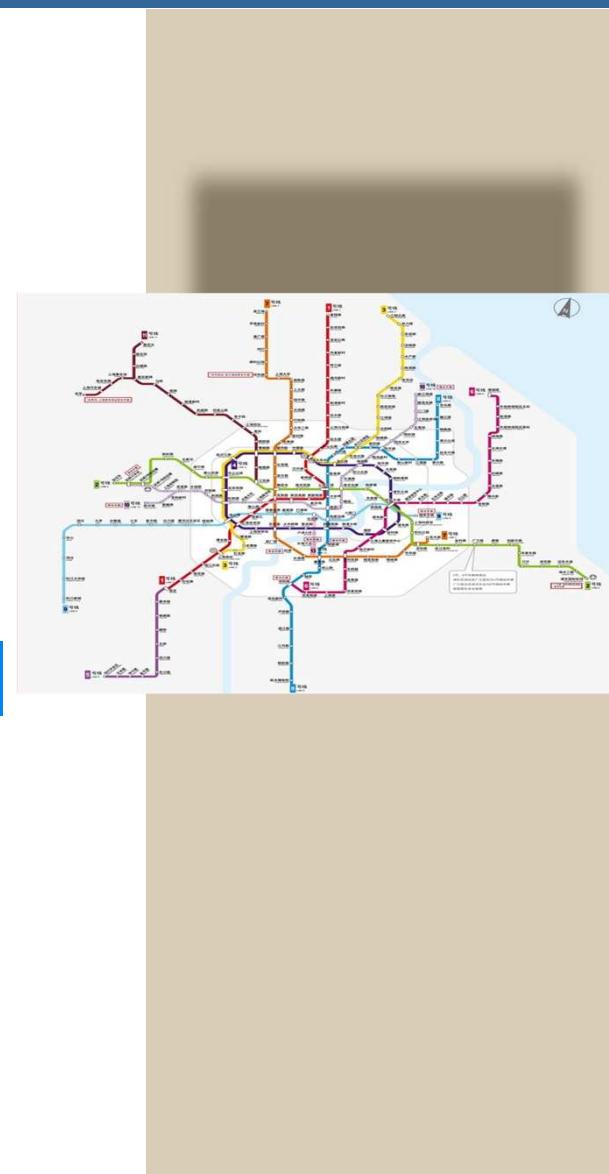
Project delivery challenges

- Increase the scale of the network (new lines, extensions, stations, etc.) a.s.a.p. **open on-time !!**
- Increase the number of trains to service those lines, extensions
- Short project schedule (especially field schedule)
- External interfaces available late in schedule.
- Revenue date fixed, so need to work around delays.



Thales answer

- Flexibility of Solution for various Schedule needs
- Customer is part of the team
- Fix the Design early
- Hardware & Software Design Optimisation
- Full in-house test environment
- Early Field Integration on a sample section
- Commission trains away from the main guideway



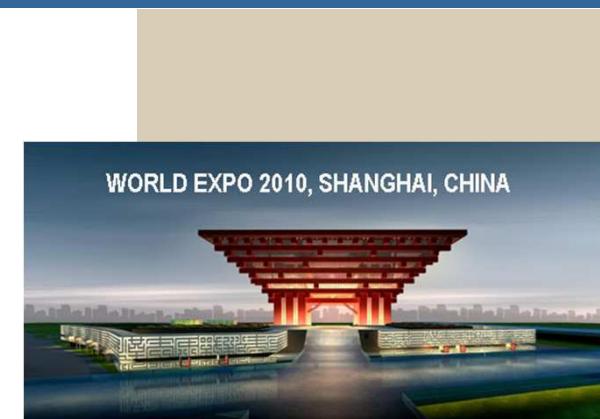
Case study: Shanghai Lines 6, 7, 8, 9, 11



Thales achievement

- Shanghai Line 6, Line 8 and Line 9 were opened simultaneously on 29-Dec-2007
- Shanghai Line 9 duration from NTP to Revenue Service was only 15 months.
- Shanghai Line 9 Extension and Line 11 were opened simultaneously on 31-Dec-2009, despite some very late civil handovers on Line 11. (L7 was opened on 05-Dec-2009)
- Line 8 extension (to expo) - March 2010, in time for World Expo

- **CUSTOMER SATISFACTION**
- The ASB-Thales-SAIC Consortium received '**2009 Outstanding Contractor for Major Infrastructure Project Contribution**' award from Shanghai Government for Line 11



Case study: Beijing Line 4



Customer challenges

- Growth of the metro system network is deemed necessary to improve mobility of 10M citizens. The government wanted to strengthen its service capacity capability and passenger satisfaction.



Thales answer

- SelTrac CBTC



Main benefits

- ATO.
- High capacity for service frequency and efficiency.
- Flexible, safe operation.
- Low life-cycle cost.

Key dates:

- Awarded 2006
- Revenue service 2009

Case study: Beijing Line 4



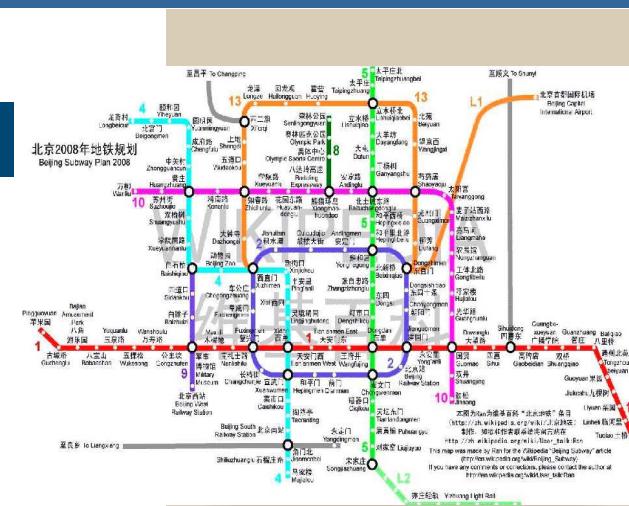
Project delivery challenges

- 17 month schedule for extension
- Staged Delivery
- Cutover - upgrade existing line and integrate with the extension
- Interface with non Thales equipped lines (9, 10)



Thales answer

- Detailed Cutover Plan
- One team approach by working day to day with the Customer to re-align resources and logistics to the project reality



Initial Line:

- 28.177km
- 24 stations
- 33 trains for the initial phase (6-car trains)
- 1 depot (with test track)
- 1 yard

Extension:

- 22 kms plus storage tracks
- Stations: 11
- Trains: 33
- Control Center: 1
- Depot: 1
- Maintenance Center: 1
- Training Center: 1

Case study: Beijing Line 4



Thales achievements

- Maximum achievable headway from day 1 of revenue service
- 700,000 passengers per day initial revenue service
- Customer satisfaction
- Both initial line and extension Provisional Acceptance Certificate obtained within one month



Key dates:

- Awarded 2006
- Revenue service 2009

Case study: Vancouver Canada Line



Customer challenges

- The first airport rail - link in Canada
- Extend the mass transit in Vancouver while providing enhanced service
- Ready to deliver for 2010 Winter Olympics



Thales answer

- SelTrac CBTC with moving-block technology for UTO operation



Main benefits

- System-wide safety
- High reliability and availability
- Flexible operation
- Expandability



18.5 km fully automated
16 stations
Capacity of 6,300 passengers per hour per direction
(expandable to 15,000)

Case study: Vancouver Canada Line



Project implementation challenges

- Schedule, Olympics
- Deliver in the “SelTrac CBTC City of Vancouver”
- New vehicle interface



Thales answer

- Flexible regarding the new “big picture” view
- Early integration of the vehicle in the factory
- Early external interfaces definition and management
- One team approach
- Leverage on local rapid transit regarding the existing SelTrac Knowledge

THALES

Case study: Vancouver Canada Line



Thales Achievement

- The first airport rail - link in Canada service commencement on August 11, 2009 (110 days early than the schedule requirement)
- Achieving consistently Availability and reliability above expected levels
- Exceeding the 3 days performance requirement of > 95% with actual values 98.75 %, 99.63 %, 99.13 %
- Delivered 24 hours service with up to 5 times the average ridership level
- Enhances Vancouver's position as a world-class Canadian city
- **“Vancouver's driverless trains have been steady winners at the Winter Olympics ... ”**
Janet Guttsman, Reuters, February 24, 2010



Case study: Vancouver SkyTrain, Canada



> Customer challenges

- With citizens opposed to construction of urban highways, authorities planned for regional growth and the 1986 world Expo, by opting for an advanced rapid transit system that could expand over time.



> Thales answer

- SelTrac CBTC offering UTO functionality and moving-block technology.
- 1st Driverless CBTC system in world.

> Main benefits

- Satisfaction and 99.7% reliability for over 20 years.
- Easy expansion to Millennium Line – mixed fleet operation.
- Management of major passenger growth.
- Automatic yard saves CAD 1M per year.

Key dates:

- Expo Line in revenue service 1986
- Millennium Line expansion in revenue service 2002



THALES



Mission-critical information systems
delivering safety and security
for ground transportation

THALES