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Determinants of Profitability

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Structure of this Presentation

1. Understanding the competitive position
2. Analysis to determine profitability
3. Monitoring internal & external factors
4. Ensuring long-term success
   – Station management

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1 Understanding the Competitive Position

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1 What are Railways Good At?

- Commuter passenger
- Heavy, longer-distance freight
- Inter-urban passenger
  - but “reasonable” speed needed

1 Understanding the Competitive Position

- Passengers and freight customers *not* simply driven by one factor
  - e.g. fare or journey time
- But by a basket of factors
  - Sparse networks & low frequencies both important in Africa
  - Overall disutility/"index of hassle" important

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1 Generalised Cost

$$G = (F/V) + b_1 t_a + b_2 t_w + b_3 t_r + n.I + b_0$$

F = Fare

V = Value Of Time

t_a = Access Time

t_w = Waiting Time

t_r = Running (in-vehicle) time

b_1, b_2, b_3 = parameters

n = number of interchanges

I = interchange penalty

b_0 = other factors (e.g. quality, modal preference)

All of the terms in the equation above have units of time e.g. minutes

- Implications are huge
  - e.g. don't reduce fares if they are not the problem

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1 Elasticities

- Need to understand how passengers & freight customers respond to changes in the different elements of generalised cost
- Elasticities are a measure of sensitivity

$$e_f = \frac{\%\text{ change in demand}}{\%\text{ change in fares}}$$

$$e_{gc} = \frac{\%\text{ change in demand}}{\%\text{ change in gen cost}}$$

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1 Elasticities

- Vary by market segment
  - journey purpose, socio-economic group, commodity
- Elasticities of components of generalised cost vary by
  - How onerous that activity is
  - The proportion of gen. cost accounted for by that activity
- Matter because of the scale of railways
  - The consequences of wrong decisions are large

2 Analysis to Determine Profitability

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2 Analysis to determine Profitability

- Profit = revenues – costs
- But, in a railway, what are costs?
  - Franchise bidding costs?
  - Vehicle replacement costs?
  - Track renewal costs?

- Highlights a key issue for railways:
  - Short-run and Long-run costs

2 Analysis to determine Profitability

- Long-term costs are a high proportion (≈40%) of total railway costs
- Many railways have focussed on short-term costs and failed to survive the asset replacement of large items

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2 Steps in the Cost Function

- Railways are inherently ‘big’ items of transport
  - Capacity comes in large chunks

- If these are not well-used, costs are too high and profit is extinguished

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2 Steps in the Cost Function

- Trainsets are a large cost element, so need to be used efficiently

- Many African railways suffer from low speed
  - Not only does this make them uncompetitive
  - But the number of trainsets required to provide the service is higher than necessary
  - Aiming for reasonable speed would reduce operating costs

3 Internal & External Factors

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3 Internal & External Factors

- 5 key factors underlie good railway profitability
  - Geography
  - Engineering
  - Management
  - Regulation
  - Economics
- Governments and railways need to
  - Understand the impact of these on their railways
  - Work together to achieve a positive background

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3 Geography: Environmental Factors

- Physical geography impacts upon
  - Construction & operating costs
  - Population distribution
  - Presence of heavy industries
  - Industrial location
  - Quality of modal alternatives
  - Existence of transit traffic

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3 Geography: Demographic Factors

- Economic geography impacts upon
  - Population size
  - Population density
  - Settlement size:
    - are there major cities?
  - Population income
  - Car ownership
  - Trip patterns
- In Africa, income is low but so is car ownership

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3 Engineering: Technological Factors

- Cost-effective technology adding value over its whole life
- Appropriate technology
- Avoidance of multiple technologies e.g.
  - Signalling systems
  - Track/loading gauges
  - Rolling stock types
- Openness towards new methods & technologies

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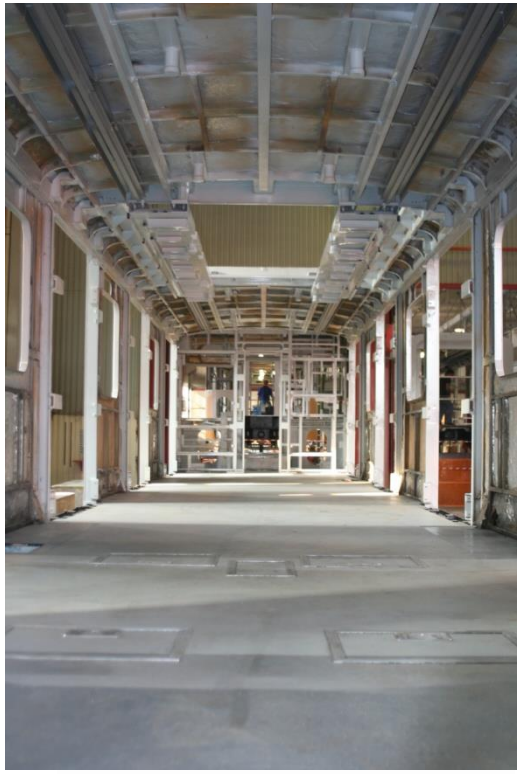
3 Engineering: Investment Factors

- System approach
- Sufficient finance to invest just before items become life-expired
- Renewal of assets to enhance performance
- Attention to ‘golden’ assets
- Cost-effective maintenance to sustain performance



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3 Management Factors

- Clear vision/purpose of company
- Sound strategy
- Power to execute objectives
- Effective means of implementation

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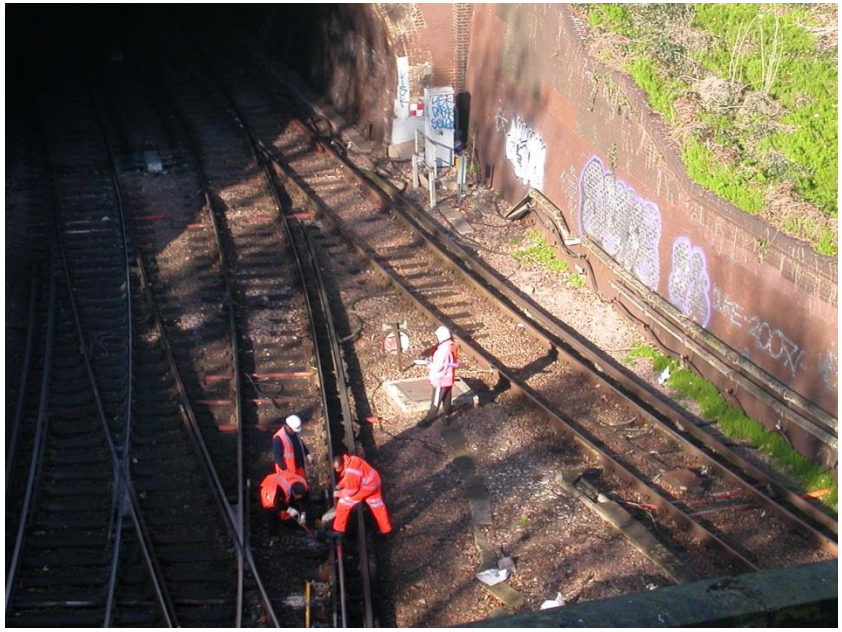
3 Regulatory Factors

- Minimum fare regulation
- Minimum labour regulation
- Appropriate safety regulation
- Appropriate service level regulation
- Appropriate financial regulation
- Regulation to encourage investment
- Financial support to offset regulatory costs

3 Road v Rail

- Regulations need to be applied equally to different forms of transport
  - Taxpayer-funded national police deal with road accidents but railway staff deal with rail accidents?
  - Roads provided free but rail customers have to pay for track maintenance?



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3 Road v Rail

- Railways often come under pressure because their externalities are greater than for road but unpriced e.g.
  - Less pollution
  - Time savings
- Other benefits are of monetary value to Government, but still have to be funded
  - Fewer accidents

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3 Road v Rail

- Other subtleties:
  - Private sector (oil/car) companies can lobby for road improvements but nationalised railways often prevented from lobbying
  - If track conditions deteriorate, we stop running (for safety reasons), but this does not stop people using roads with potholes
    - If Governments are not careful, these policies encourage travellers to use less-safe modes

3 Road v Rail

- Other subtleties:
  - Public transport (esp. railways) allow a denser more sustainable urban form
  - Map shows proportion of New York which would have to be car-parks if there were no railways

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3 Economics: Operational

- Ensure good terminal location
  - City-centre: nearest most trip ends & easiest for interchange

- Avoid demand peakiness
  - By time of day
  - Geographically (i.e. not branch lines)

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3 Economic Principles

✓ Density: more traffic on same railway

? Scale: more traffic on bigger railway

X Complexity: more types of traffic/assets

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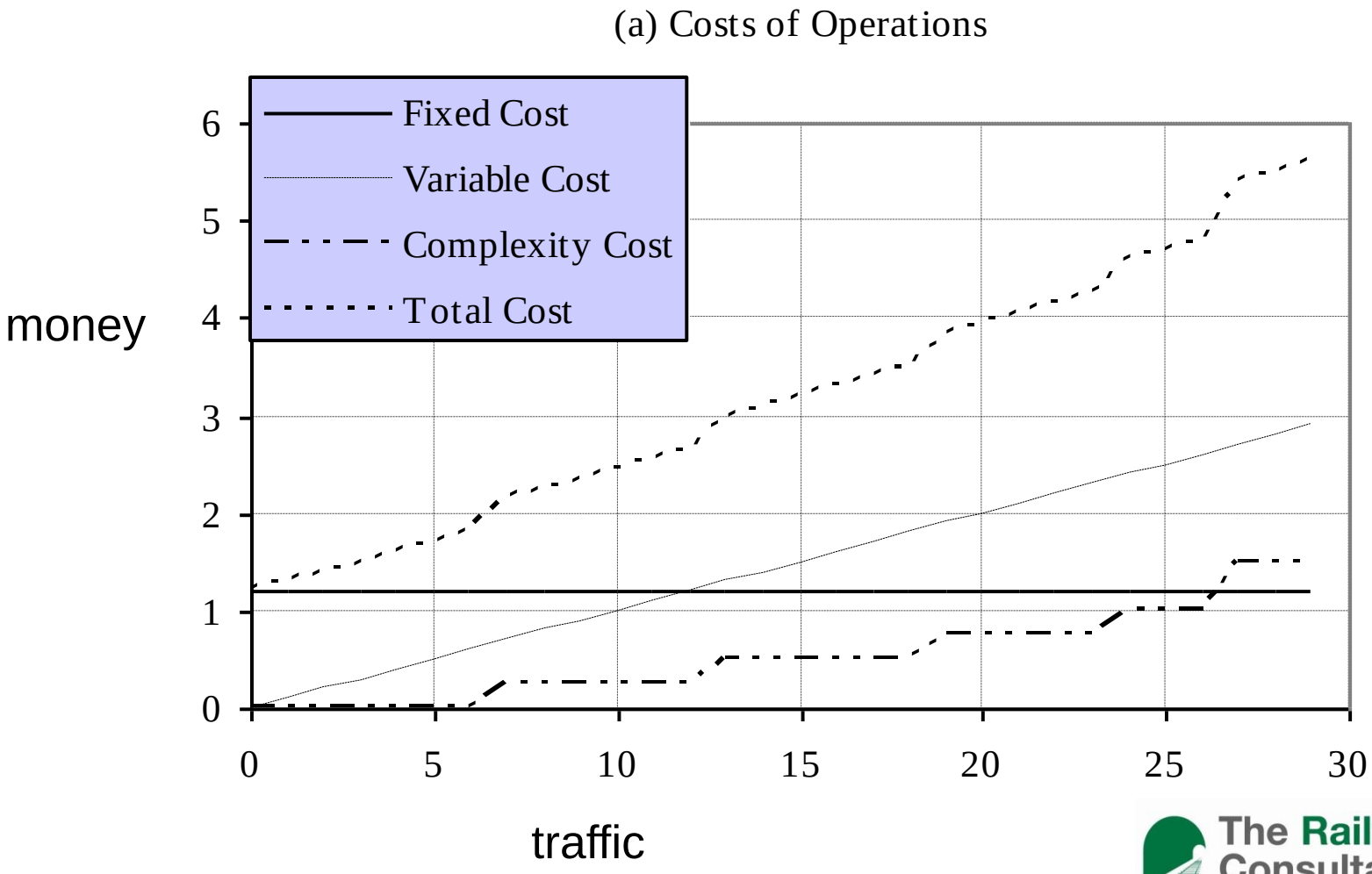
3 Short- and Long-run Costs



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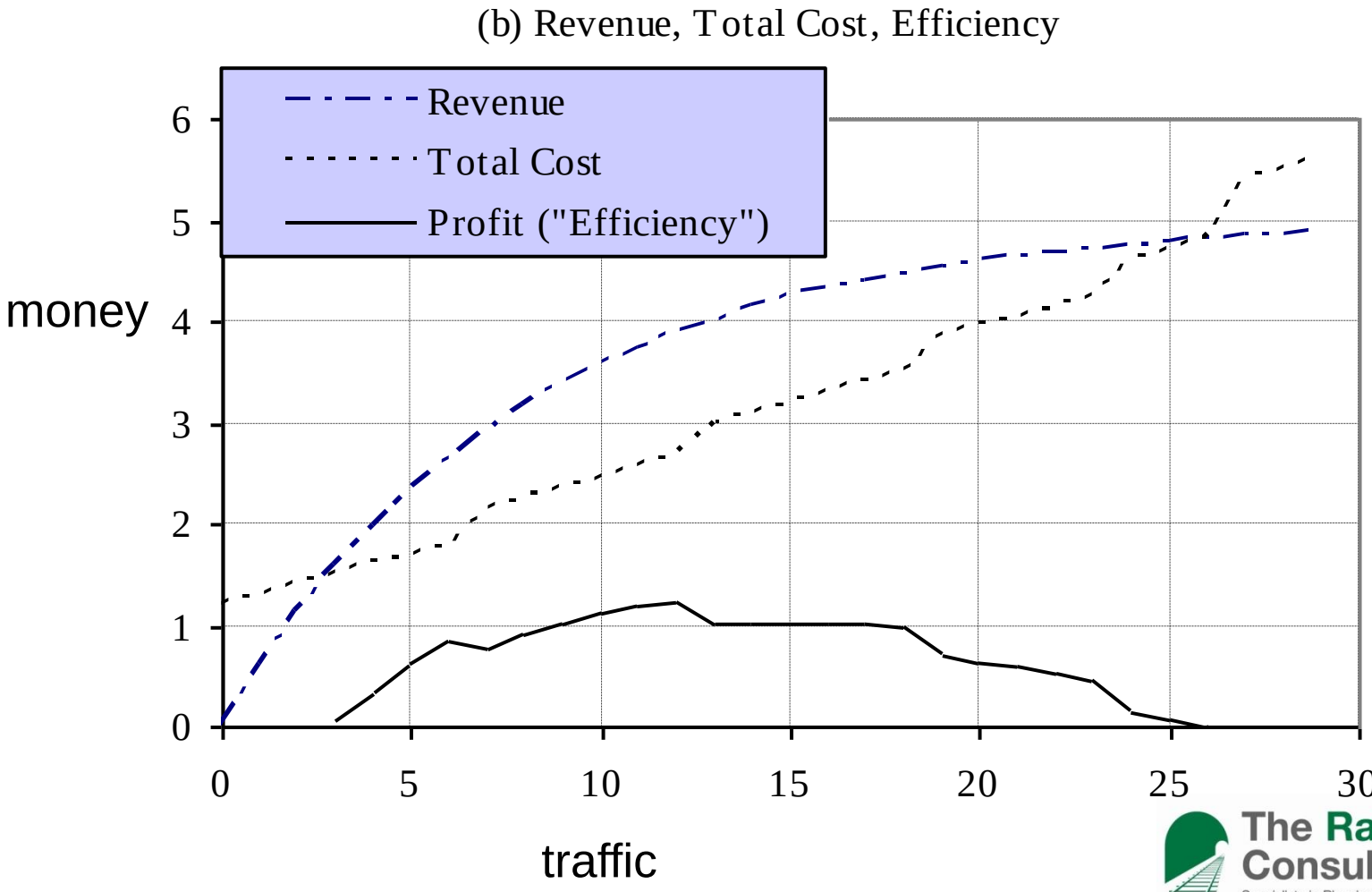
3 Costs and Revenues



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4 Ensuring Long-Term Success

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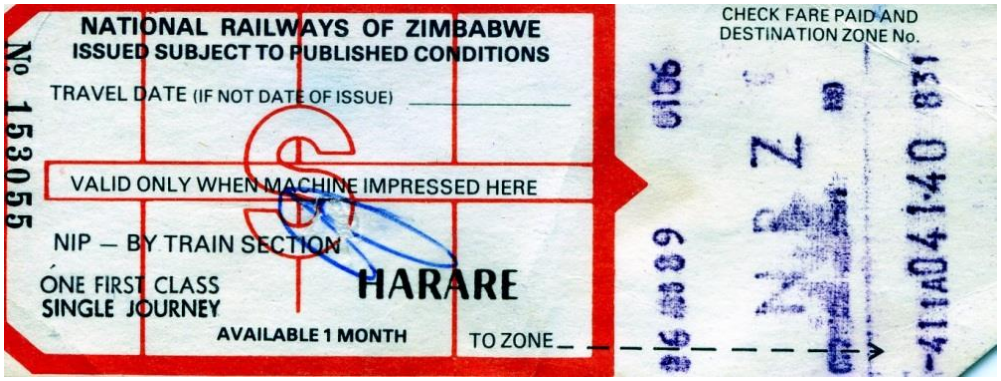
4 Controlling Costs

- Railways have high fixed costs naturally
- But overheads must be controlled
  - e.g. railway running 1 train per week with 750 staff in head office
- If conditions require high railway employment, use it in customer-facing roles e.g. on-train staff, ticket offices

4 Ensuring Long-Term Success

- Fares/charging policy
  - Don't under-price rail *or road*
  - Should cover operating costs and make some contribution to long-run costs



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4 Ensuring Long-Term Success

- Asset management
  - System to plan & replace assets
  - Stable funding needed from Government
  - Commercial fares/freight rates help to support this approach and encourage managers to consider income *and* costs

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4 Ensuring Long-Term Success

- Systems engineering
  - Everything impacts on everything else
  - Minimising costs in one area may mean spending more elsewhere
- Technology decisions
  - Unsprung loco weight
- Planning decisions
  - Length v frequency

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4 Ensuring Long-Term Success

- Operational and safety management
  - Poor safety impacts directly on the bottom line
  - Good operational management is essential if Governments are to trust the railway with mass transportation

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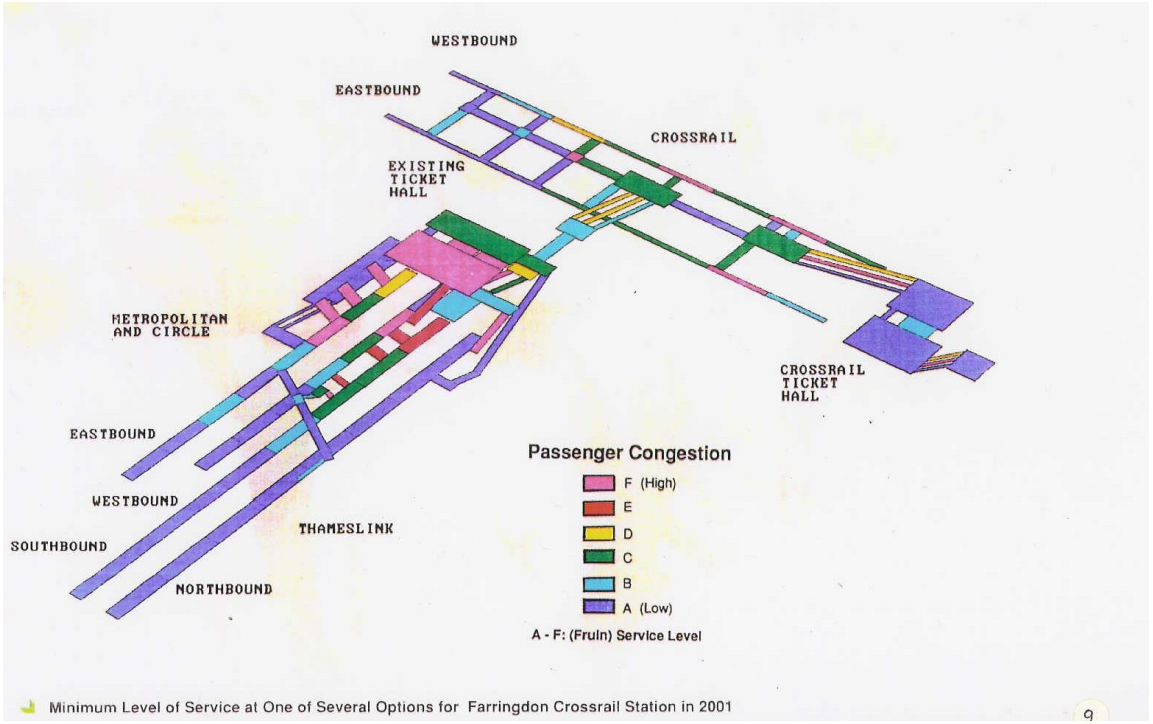
4 Management of Stations

- Once demand rises, this is not as easy at it appears; key concerns are
  - Safety
  - Punctuality
- Railways are a system, so need to manage
  - Rolling stock
  - Platform infrastructure
  - Passenger flow

4 Understanding Passenger Flow

- Fruin's level-of-service categories
  - A to D are OK, E and F aren't
  - for efficiency as well as safety reasons, plan to avoid congestion



Minimum Level of Service at One of Several Options for Farringdon Crossrail Station in 2001

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4 Understanding Passenger Flow

- Implications & subtleties often not understood
  - Bottlenecks
  - Edge effects & corners
  - Logical sequence of tasks
  - Clear sightlines
  - Good information

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4 The Platform:Train Interface

- The rationale for stations
- Safety-critical

- …but also
- Capacity-critical: in urban areas, railway line capacity determined as much by station stop times as by anything else

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4 The Platform:Train Interface

- On high-volume passenger railways, detail matters
- Active management is essential – but doesn't have to be "high-tech"

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4 The Platform:Train Interface

- Have research database from a range of urban and metro railways
- 100 datasets, each of around 30 observations
- Record numbers of passengers, passenger time, function time and station characteristics
- …all at the critical door

➢ Spreading passengers out is critical

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4 The Platform:Train Interface

- Although passengers are timed at a particular door, doors are of different widths
- We therefore use passengers/second/metre of door width as the unit to describe movement

- Most train doors are about 1.2m wide
- Passengers get on/off at ≈1/second
- Average rate ≈ 0.8 pass/s/m

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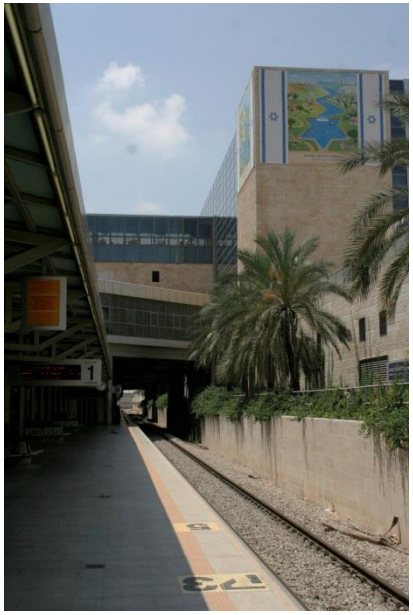
4 Recent Research

- Results from our research demonstrate systems engineering in practice
- Have used multiple linear regression on our dataset to be able to estimate the impact of different input factors
- Now able to report
  impacts of station factors



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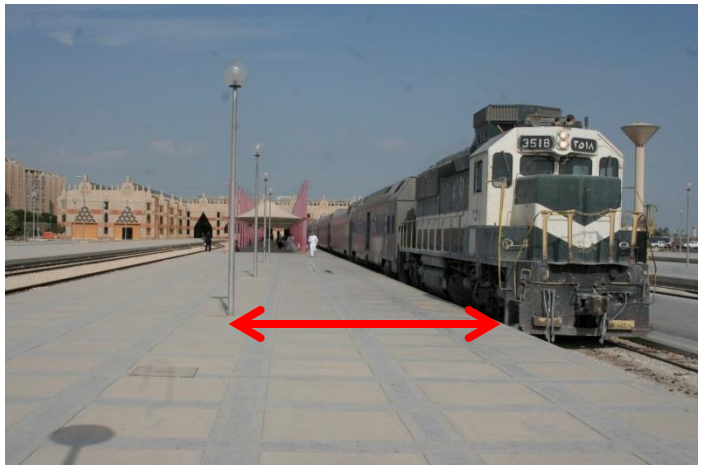
4 Recent Research

- Separate platforms for boarding & alighting



- Platform width

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4 Recent Research

- Results give us guidance as to good practice:

Design Feature	Unit	Parameter	Interpretation
Platform: train gap	10 cms	-0.06 (-8%)	10 cm larger gap leads to 8% reduction in boarding rates
Separate platforms for boarding & alighting	Yes/no	0.55 (68%)	Availability of separate platform increases alighting rates by 68%
Platform screen doors	Yes/no	-0.02 (-2%)	Installation of PSDs reduces alighting rates by 2% (although has other benefits)
Platform width	Metres	0.07 (8%)	1m wider platform increases alighting rates by 8%

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5 Conclusions & Recommendations

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5 Conclusions

- Basket of factors underlies choice of rail
- Rail is not the appropriate choice for everything
- Range of key factors underlie railway profitability
  - Some are inherent characteristics of the situation
  - Some to be managed by Government
  - Some (e.g. overall speed) a joint decision
  - Others (e.g. asset/station management) by the railway

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5 Recommendations

- Target those markets for which rail is appropriate
- Agree objectives
- Sustain stable (high) funding
- Keep costs down, especially overheads
- Ensure a level playing field with other modes

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