



Operating the world's longest and heaviest train – A risk based approach to defining the limits of railway operations

Trent Ludlow

Introduction and Acknowledgement of Country

- Trent Ludlow – Quick overview of my career (sorry to bore you)
- I would like to acknowledge the Kariyarra, Ngarla, and Nyamal people as the Traditional Custodians of the lands where this train was run
- I recognise their strength and resilience and pay respect to their Elders past and present.



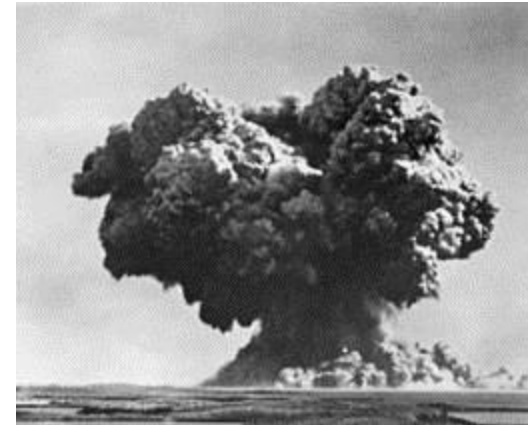
Overview of the Pilbara Region

- Indigenous settlement occurred prior to the Last Glacial Maximum (between 30 and 40,000 years ago)
- Extremely old – >2.3 Bn years - first primordial bacteria occurred in the Chichester ranges
- European settlement commenced in 1861
- Mainly mining based (Gold and Blue Asbestos)
- Due to the harsh climate European settlement began to wain
- Iron Ore was seen as a strategic asset for Australia in 1961 this decision was repealed
- Iron ore deposits of high grade and easy extraction identified



Iron Ore Mining in the Pilbara

- Iron Ore forms the backbone of our post industrial world. It is one of the key components of steel
- (Off track but important to NZ) coking coal or black coal
- The British tested their first A bomb off Dampier in 1952
- The worlds worst heatwave recorded in this region
- Asbestos mining was occurring in Wittenoom
- Iron Ore Mining commenced at Tom Price and Goldsworthy in the mid 60's
- Construction commenced on the Mount Newman project in 1966 with the railway open in 1969



The Mt Newman Railway

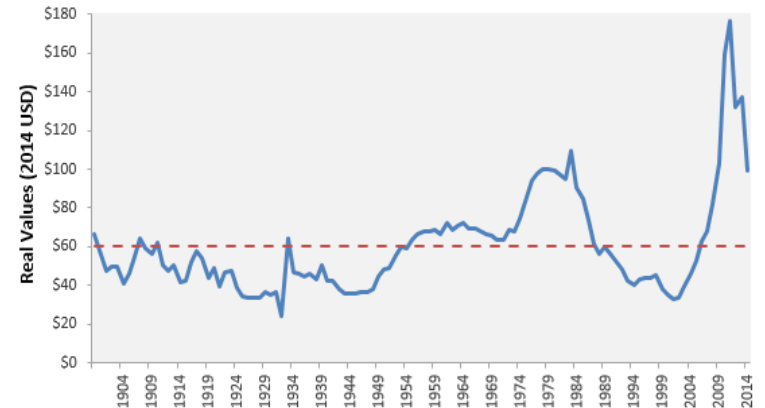
- Railway established to run iron ore built by Utah Development Company
- Built by MKO who also built the Rimutaka tunnel
- Built cheaply 25 ton axle loads – Oroville Dam reused equipment (except locomotives) – including the dumper
- Built quickly broke the then track laying record – 7kms in one shift
- Track laid at 533mm sleeper centres with 132 lb rail
- Worked with Alco locomotives and ex-Oroville wagons
- Barrier to entry for this market is upfront capital as the mining process is simple



Investment decisions prior to the Iron Ore Boom

- Investment minimal – prior to 2005 focus was on 1 – 2 year payback
- Marginal commodity until 2009
- Locomotive fleet rebuilt from Alco's to Dash 7 and Dash 8
- Dash 7's and Alco's limited by early versions of locotrol
- Dash 8's did not require wagon (pie van) support
- Rail/Wheel Profile – enabled extension of axle loads – higher axle loads more tonnes less rolling stock
- Bridge strengthening and loading review
- Redesign of bridge waterways to improve resilience
- AC 6000 loco's purchased
- Pilbara region pushed forward in axle loads and tonnes whilst US remained constant at 32.5 tons (286,000 lb cars are still being rolled out)

Iron ore price per tonne



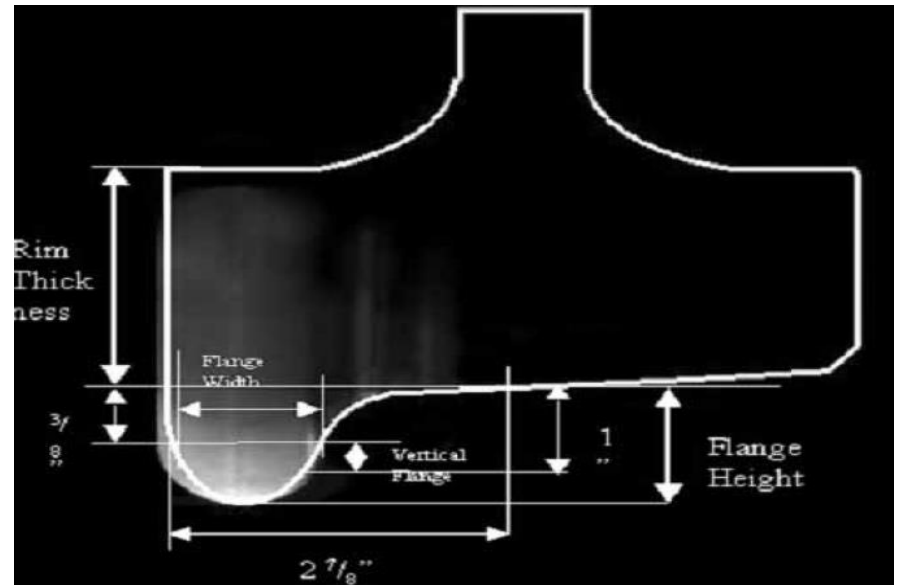
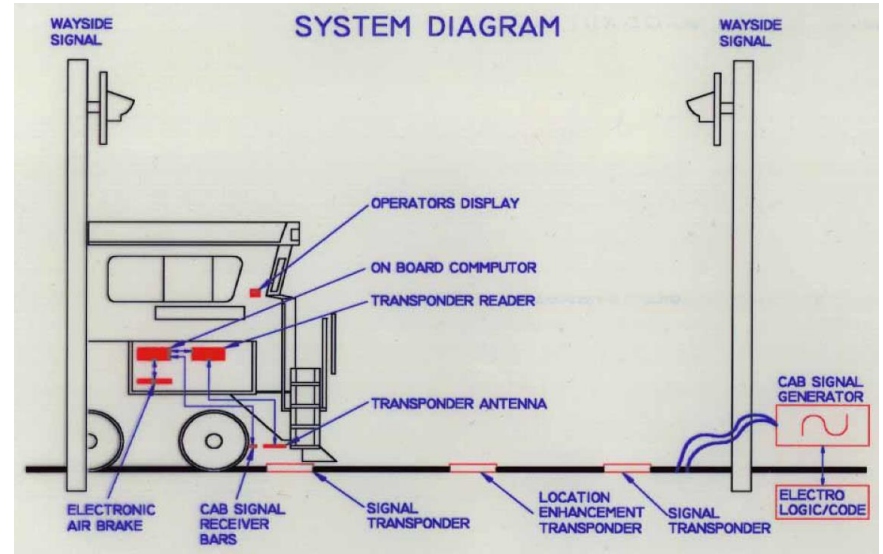
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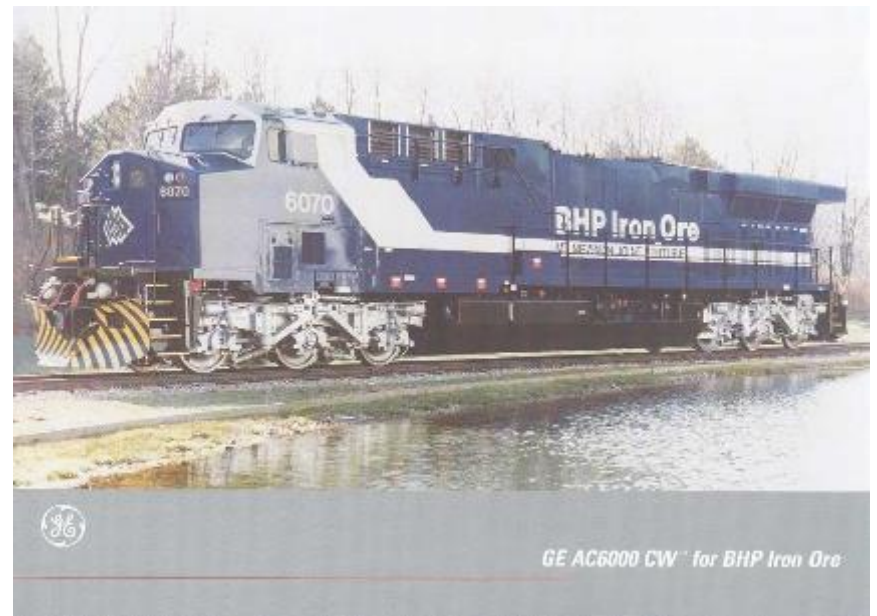
Investment decisions prior to the Iron Ore Boom

- ATP installed in locomotives in 1996 as a secondary safeworking system – key enabler for DOO
- Locotrol – reduced requirement for banking – (crew, fuel and loco efficiency)
- Railbam
- Cold wheel detector (reduces TX time)
- Hot wheel detectors
- Wheel impact load detectors
- Video imaging – Handbreaks, wheels, etc (catches handbreaks and reduces tx time)
- Instrumented wagons – automatically downloaded – hunting and drawbar forces
- Train Driving Simulator
- Implementation of G class short bearings – enabled 35 tonne + axle loads



The world record train

- 8 x AC locomotives – each loco had an increase of 70% in Tractive effort over DC equivalents
- Reviewed culvert and bridge loadings
- Locotrol enabled train to be treated as normal train due to normalization of in train forces
- Ran train configuration through train simulator- defined max drawbar pull
- Trained crew on the simulator
- Optimum performance as per ore car and simulator runs
- **Train length 7.353kms – 99,353 tonnes**
 - 2 x loco - 168 wagons
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 - 1 x loco – 178 wagons
 - 1 x pusher loco



Learnings

- The simulator provided an output that closely mirrored the operation of the train
- AC locomotives offer better value for money than the equivalent DC locomotives
- Understand the latent capacity of the infrastructure and think about how value creation can be enabled
- Distributed Power provides an option to configure locomotives and wagons in a manner that reduces in train forces whilst optimizing the business outcome – reduce opex and capex outlays
- Draft gear research after this train led to the introduction of forged knuckles and yokes – balance between preventing in train failures and moving the stress into the draft pocket
- G class bearings generated sufficient stretch capability to safely operate 40 tonne axle loads
- Need to keep challenging the status quo to reduce costs and cycle times

