The Day After Tomorrow For Brownfield Terminals
Digital Journey

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TBA Group Experience - Design, Operations & Software

✓ TBA – Globally a recognized leader in terminal design, simulation, optimization & terminal automation.

✓ 9 of top 10 largest global operators use TBA services including, DP World, AP Moller terminals, PSA, Hutchison etc..

✓ TBA has worked on many of the cutting edge & most innovative terminals. APMT Maasvlakte II, Rotterdam World Gateway, Long Beach Container Terminal, Euromax, London Gateway, Khorgos Rail (OBOR-Rail terminal Asia-Europe)

✓ TBA’s Equipment Control System (ECS) is controlling majority of the AGVs operating in fully automated container terminals. TBA has been providing this software for +18 years, linking to TOS & handling equipment.
Background

- All new greenfield facilities in high labor cost locations are now being built with high degree of automation. Many mid/low labor cost places are also going for greenfield automation.

- **Greenfield Vs Brownfield** automation – a sample. There are still only very few Brownfield conversion!

ASC conversion has been the most common mode. It allowed yard automation while retaining horizontal transport

- Why are Brownfield so few and are they so different?
Challenges: **brownfield automation** – to name a few

- Continuation of existing operation during transition
- Maintain capacity/create over-capacity for transition and avoid any loss in performance
- Higher yard density is most often desired for the future
- Integration with existing operating modes (example horizontal transport)
- Impact on existing infrastructure
- Challenges and integration of system – TOS, etc.
- Is it retrofittable
- Existing labour & social impact
- Proof of concept, testing & implementation
- Change management

**Question** – How to approach / plan for Brownfield transition to automation?
The day after tomorrow for brownfield terminals
Key message & a quick digital journey

Key message

- The digital journey/transformation for brownfield sites is best advised via a stepped approach & leveraging the existing infrastructure (hardware & software)

- There is no one size fits all as local conditions are very different. It is recommended to exercise due diligence before wholesale adoption of a singular eco system or copy/paste from a particular site

Digital journey for brownfields using a few examples
- Brownfield automation of Straddle terminals – two different approaches
- RTG (especially relevant based on exciting new developments)

What is needed for success

- Conclusion
Let us go on a digital journey
Brownfield Straddle Automation
Stepped change – Ports of Auckland
Let us go on a digital journey:
**Auto Straddle Carrier – decoupled roll out (Site specific conversion plan)**

**Manual Water side** (Yellow Straddle)

**Automated main yard** (Blue straddle)

**Benefits**
- Staged implementation - use existing infrastructure
- Maintain SC drivers - social impact of transformation
- High performance on water side +34-36 gmp/h
- Yard capacity increased with 1 over 3 Auto SC

**Some key facts**
- Serve complex 2 perpendicular berth arrangement with rotated yard
- Decoupled support high performance for a highly competitive environment
- Service rail & empty with directly with Manual-SC, no gate handling for rail

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Let us go on a digital journey:
Auto Straddle Carrier – decoupled roll out

Location issues
- 2nd berth required due to escalating container vessel size
- Current QC rate 36 GMPH. Decoupled supports high performance in a highly competitive environment
Digital journey
Brownfield Straddle Automation
Big-bang conversion – Patrick Botany
Digital journey: (Observations)
Different strategy – Full Auto Straddle Conversion Botany

Successful conversion manual SC to Auto SC in 2015, but totally different strategy

- Labor conditions required a big-bang. Extensive preparation were made, terminal stopped for 4 days and restart without labor in the yard
- Big bang supported by spare yard for testing & overall
- Brisbane auto-SC terminal - same software, hardware, many similarities. Minimize any change – layout, operations etc.
- Productivity of 24-28 gmph was considered acceptable & good
- After 4 years, production is better than the 2 other terminal in Botany. Plus terminal has a lower OPEX cost.
- Transition step – rail handled by double handling via truck grid.
- Would this strategy work for Auckland or should Auckland strategy be applied here? No. These facilities required customized strategies

TBA was not involved with this roll out project
RTG Automation
ARTG 1.0 & ARTG 2.0
Steps for conversions minimize risk
ARTG 2.0

- Same RTG block, retrofittable, un-compromised traffic
- Switch blocks
- ARTG 2.0 opens new frontiers for brownfield automation
- 1 supervisor to handle multiple machines
- What next - deploy auto truck for water side! Land side & auto truck mixing (very exciting potential opportunities)

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The digital journey for brownfield facilities
Automating RTG dispatch – Tanjung Pelepas
RTG productivity is highly variable on an hourly basis.

Observations at current RTG operations:

- RTGs have individual performances from 1 to 25 productive moves, but the average is typically ~ 8 to 12 up to 16.
- Typically one RTG is very productive one hour and not so productive the next due to work load distribution.
- RTG dispatching is done manually - With high numbers of RTG it becomes more challenging to distribute workload!
- Solution – Yard crane Scheduler – Use AI to Automate RTG dispatching?
The digital journey for brownfield facilities - RTG terminal
Increasing a challenge to manage RTG workflow

Solution....... Use AI to dispatch RTGs

Yard Crane Scheduler - PTP
Automated dispatching of RTGs - using AI

TBA Yard Crane Scheduler (YCS)

Moves are added in real-time to the schedule from vessel, gate or rail

Zone assigned to 1 yard crane, with all the moves in time, and their execution position in the yard

Optimized path, with recommended number of RTGs per block
Each path shows a separate RTG

Neighbouring RTG helps out automatically, workload is spread over the available cranes, no more uncovered moves
Digital journey
What is the benefit? Euro 1.8 M a year! (Only software)

Labour cost: 25€/h

Operational cost per year:
- QC
- RTG
- TT

Improvement of RTG productivity: +10%

1M TEU operation

Observed +15% RTG improvement!

Savings in CAPEX & QC GMPH (+3%) is additional

RTG dispatch issue is not solved by ARTG 2.0 in itself it requires improved scheduler or an added YCS module!
### High level conversion levels: minimizing risks

**Step 1: Process automation**
- Automated decision making/stacking
- Gate automation
- Vehicle booking system
- Automated RTG gantrying
- Identification on trucks (e.g. RFID)
- Automated PDS on RTG

**Step 2: Automated dispatch**
- Limited human intervention
- Effective auto zone setting
- Effective job sequencing
- Exception management

**Step 3: Remote control**
- Operator in office
- Camera view
- Complete move operated remotely
- Possibly pooling of RTG’s
- Automated RTG gantrying

**Step 4: Partial automation**
- Move inside stack fully automated
- Exception handling by operator
- Truck handling remotely
- Multiple RTG’s → 1 operator

**Step 5: Full automation**
- All moves fully automated
- Exception handling by operator

**Step 6: Auto – Trucks**
**Conclusion:**

**Mind shift change for brownfield sites**

- Software is getting smarter and exciting & new automation hardware (A RTG, Auto truck, A-SC) is opening up new frontiers for terminal operations. We are all in for a fascinating next few years!!

- While greenfield automated terminals can build an IT infrastructure from the ground up

- The digital journey/Transformation for brownfield requires a different approach
  - Best advised via a stepped approach & leveraging the existing infrastructure
  - Creating an appropriate stepped plan for transition, well suited to local site requirements is the key for successful brownfield conversion
  - Exercise due diligence before wholesale adoption of a dedicated eco system or copy/paste from other success stories

- The focus has to shift from “project based” developments to “product based” developments, such that most appropriate solution can be more readily deployed interconnecting best of hardware, software & controls systems (without necessary having to following only one dedicated eco system)
Brownfield Automation: AutoRTG + AutoTT
a look into the future by TBA

In future, best preforming brownfield terminals are likely to be adopting a more flexible, agnostic & modular approach

Using a mix of best of bred hardwares, control systems, software, optimization tools with good data sharing/exchange

Animation
mixing of external trucks & auto trucks on an auto RTG terminal
Thank you for your attention

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