Busan New Container Terminal: growing smartly for a big future

With its first expansion completed in June of this year, Busan’s newest terminal has room to grow again before reaching its full 3.5+ million TEU capacity. With a 1.8 million TEU annual volume, Busan New Container Terminal (BNCT) still has decisions to make regarding the optimisation of its equipment, processes and design to accommodate the rapid container shipping industry changes directly impacting Busan Port.

In fact, BNCT’s terminal design and its phased approach to realising its full capacity are deliberate mechanisms to ensure optimisation of capital investment which, in turn, mandates improvement to the design of the terminal itself and enables BNCT to maximize its main advantages of speed and flexibility along the way.

Industry Change
Ideally located as the North East Asian transshipment hub and designed to accommodate future growth, Busan New Port is seeing the full effects of container industry vessel and call size growth as well as further customer consolidation. With all other existing terminals operating close to their full capacity, and no new terminals planned to become operational in Busan Port until 2020, BNCT has a big responsibility to keep up with the industries requirements in this market.

Mega-Ship
Since opening in 2006, New Port has seen a steady increase in volume and a more recent steep increase in size and number of mega-ship calls with Triple E class 18,000 TEU vessels calling at Busan New Port since July 2013, and MSC’s 19,224 TEU Oscar choosing New Port for its maiden call earlier this year. Rapid vessel size increases in Busan’s New Port are expected to continue for several reasons:
- Mega-vessel deployment will continue to increase on current and new services calling at Busan
- The majority of East-West mainline services already call Busan’s New Port
- All global shipping alliances are in New Port with further expansion or consolidation likely
- New Port’s terminals can easily handle vessel rows of 24 across so services planning to expand vessel sizes over 10,000 prefer New Port
- Busan Port Authority (BPA) will continue dredging works which will see 17 metres of draft ensured for all of Busan New Port and the main sea route in 2016

Terminal Design
One of the most critical advantages of BNCT’s terminal design is the phased approach to its expansion because it enables BNCT to optimise its structure as well as equipment as volume grows. By phasing BNCT’s expansion towards realising over 3.5 million TEU in capacity, planned investment can be adjusted as the performance of the initial layout and equipment is proven and more is known about future requirements, as well as the impact of market trends.

Big equipment for big ships
An obvious benefit of a phased expansion is the ability to upgrade equipment specifications in response to growing vessel sizes and volumes relatively quickly. As illustrated in Figure 2, BNCT started with eight already large super post-panamax cranes of 24 rows outreach. However, for its Phase-2 (and recently completed) expansion in response to even larger size vessels, BNCT increased the height of its three newest cranes (fully commissioned in June, 2015) by 6 metres to ensure easy clearance of the tenth tier on deck. Furthermore, BNCT can easily increase its current average gross quay crane

Figure 1: Increase in vessel size in New Port since 2012

Figure 2: BNCT’s Phased Expansion

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Figure 2: BNCT’s Phased Expansion
productivity of 32 moves per hour with 2.5 straddle carriers per crane to 35-40 moves per hour simply by introducing additional straddle carriers.

**Optimising the yard**
Another benefit of BNCT’s phased expansion approach, and one that could only be discovered after many months of operation, is the enhancement of our yard design. When comparing actual volume to yard utilisation levels at all operational times of the day and week, BNCT was able to decrease the number of additional yard blocks by two and associated number of automated stacking cranes (ASC’s) by four for BNCT’s Phase-2 expansion.

Not only did this save millions of dollars in capital investment, it also allowed BNCT to create 16,000 additional ground slots of empty yard space; a rare competitive advantage in New Port and one that will allow BNCT to improve the performance of its automated yard for discharging and loading full containers even further.

**Buffer Zones**
Larger call sizes mean bigger fluctuations in the use of and strain on various terminal resources at different times. BNCT’s design allows flexibility to efficiently handle these peaks on various terminal activities through the creation of three buffer zones depicted in Figure 3. These buffer zones mean that each piece of equipment is able to operate independently.

**Speed and flexibility**
Because of steep volume increases since BNCT’s Jan 1, 2012 opening to over 1.8 million TEU annually, BNCT must constantly ensure maximum benefit of its design and resources is delivered to cope with and prepare for increased strain on capacity and equipment that larger call sizes bring. As the first perpendicular-automated yard terminal to open in Asia, BNCT is designed to accommodate mega vessels with 1,400 meter of quay, 16+ metre drafts, semi-automated yard and gates, large modern equipment and a terminal operating system to match. Though each of these design aspects are a prerequisite to be able to handle the largest vessels in the first place, it is the combination of all of these that deliver the speed and flexibility of operations needed to handle more extreme volume peaks and troughs efficiently.

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**Table: BNCT’s Phased Expansion**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Status</th>
<th>Phase 2</th>
<th>Phase 3 (Future)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>1 Jan. 2012</td>
<td>1 June 2015</td>
<td>TBD</td>
</tr>
<tr>
<td>Total STS</td>
<td>8</td>
<td>11</td>
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</tr>
<tr>
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<tr>
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<td>23</td>
<td>26</td>
</tr>
<tr>
<td>Total Handling Capacity</td>
<td>1.8 mil TEU</td>
<td>2.5mil TEU</td>
<td>3.5mil TEU+</td>
</tr>
</tbody>
</table>

*Adjustable depending on volume and market trend*

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*Figure 2: BNCT’s Phased Expansion Approach

*Figure 3: BNCT’s Buffer Zones*
without having to wait for the previous or next piece of transfer equipment to finish by allowing multiple containers to build up in each Buffer Zone before needing to be handled.

For example, each of our 21 yard blocks can accommodate 6 trucks wanting to deliver containers simultaneously in the land-side buffer zone. BNCT’s system will automatically monitor this and adjust itself to handle this peak in gate activity by pre-staging export containers in the yard instead of putting them in their final resting place, enabling a much faster transfer of containers from trucks into the yard. Similarly, the reverse is also true for handling peaks in discharge activity at the water-side buffer zone, with 32 import TEUs able to be stacked at each yard block by BNCT’s straddle carriers before needing to be moved by our ASC’s into the yard.

**Double cycling**
Perhaps BNCT’s biggest opportunity for vessel productivity improvement for even larger call sizes in the future and a clear advantage of it’s perpendicular-automated yard structure versus other conventional truck and trailer terminals is the ability for all our equipment to double cycle at almost every stage of operations. For example, our quay cranes have the ability to load a container then immediately discharge another below deck, having the optimum impact on overall berth productivity. Theoretically, the larger the call-size the more opportunity vessel planners have to optimise stowage enabling the terminals quay cranes to load and discharge during the same cycle more often.

**Traffic flow**
As call sizes increase, so does the need to accommodate large in and outflows of trucks and to ensure that traffic flow is fast and uninterrupted. BNCT’s automated pre-gate enables this by identifying the container before arriving at the gate by reading the trucks RFID tags. This allows separation of any containers with incorrect or missing information from the main in-flow lanes, keeping them fast and efficient. BNCT is currently reviewing additional automated technologies for even further process improvements in this area.

Also, because trucks to not have to travel far from the gate to pick up/deliver containers from/to the yard travel distance is minimised. Because pickup and delivery happens at any one of 121 transfer points, outside the yard and the main flow of traffic, constant and safe movement of trucks is ensured. BNCT’s average truck turn time is well under 15 minutes.

**Emulation system**
The tool that enables BNCT to keep improving and adjusting along the way successfully, despite so many design, equipment and fluctuating vessel operations, is BNCT’s emulation system. As volume grows and variables increase, BNCT’s emulation system can record an actual vessel operation which can be played back in different scenarios by adjusting various system parameters. This allows us to identify possible parameter and system changes to make our system even more efficient and to handle ever-changing volume mixes between imports/exports, containers and transshipment.

**About the organisation**
BNCT Co., Ltd. is an independent full-service container terminal with a capacity of 2.5 million TEU able to increase to 3.5+ million TEU in the future. As the most advanced terminal in Korea and the first perpendicular – automated yard structured terminal in Asia, BNCT can berth 3 of the world’s largest container vessels simultaneously at 1,400 metres of quay with 16-17 metre water draft and the biggest and most technologically advanced equipment, terminal operating system and automation technology to match.

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