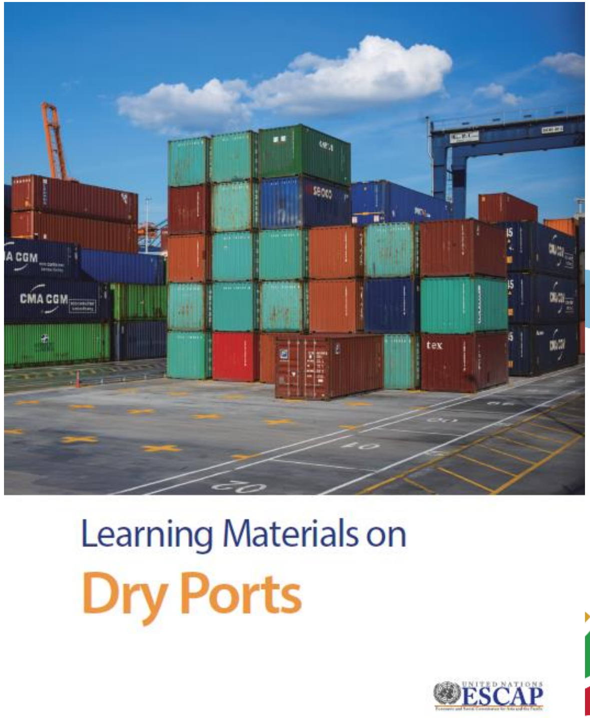
Strengthening Subregional Connectivity in East and North-East Asia through Effective Economic Corridor Management
Training-Workshop Series: Workshop 1

Lecture 2: Dry Ports

Fedor Kormilitsyn
Transport Division, ESCAP

7 October 2020



UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Content – Part 1

1. Definitions and functions
2. Economic benefits
3. Intergovernmental Agreement on Dry Ports
4. Enhancing border control functions of dry ports

Item 1. Definitions and functions

Freight modal interchanges:

- terminals which allow transfer of freight from one transport mode to another – usually from road to rail;
- can handle all types of freight except bulk, but mostly handle containers or other types of unitized freight (e.g. pallets; steel bundles);
- if equipped and authorized for border clearance of cargo are called “dry ports”, alternatively “inland container depots”, or “inland clearance depots”

Dry port

Definition:

- “an [inland logistics centre] connected to one or more modes of transport for the handling, storage and regulatory inspection of goods moving in international trade and the execution of applicable customs control and formalities” (***Article 1 of Inter-governmental Agreement on Dry Ports***).

Dry port

Definition (continued)

- *as name implies, a "Dry Port" provides all of the services of a port except for the loading of cargo to and from seagoing ships.*

- *may be distinguished from an ICD in that it can accommodate all types of cargo (though usually not bulk cargo), whereas an ICD specializes in the handling of containers and containerized cargo*

Dry port

Functions:

- Container handling and storage
- Container stripping and stuffing
- Breakbulk cargo handling and storage
- Customs and other border controls inspection and clearance
- Container light repairs
- Freight forwarding and cargo consolidation services
- Banking/insurance/financial services
- Transport booking/brokerage
- Value added services (e.g. packaging, labelling, long term warehousing)

Item 2. Economic benefits

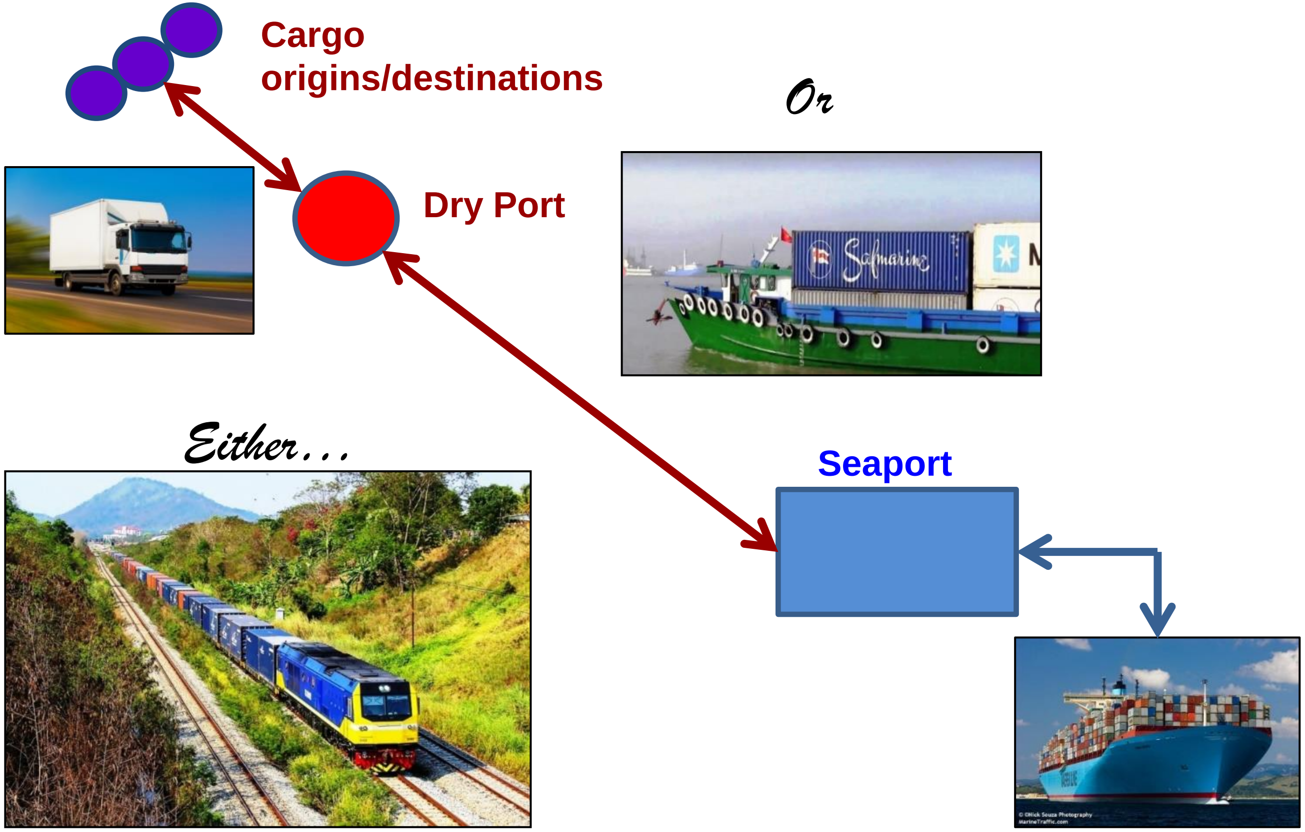
- Dry ports allow diversion of cargo movement from inefficient to efficient combinations of transport *(mainly all road to rail plus road, but also all road to IWT (where applicable) plus road*

- Benefits arise from modal diversion in *four* ways:
  - *through a net reduction in transport operating cost* which will induce increased trade
  - *through a net reduction in environmental damage*
  - *through a net increase in public safety (reduced accident costs)*
  - *through a net reduction in transport infrastructure maintenance cost*

2.1 Potential for net reduction in transport operating costs (1)

- Dry ports located close to the cargo sources (or trade generating locations) and distant from a seaport will allow transport costs to be optimized by employing:
  - small-medium trucks for transport of breakbulk cargo between cargo source and the dry port
  - rail or IWT (if available) for transport of containers between the dry port and a seaport

2.1 Potential for net reduction in transport operating costs (2)



Cargo transport cost between cargo origin/destination and seaport with and without dry port

1. Pre-dry port

Transport of breakbulk cargo by truck (320 km)

Cargo origin/destination		Seaport
	Truck operating cost, per tonne-km: : $ 0.055 Total cost to transport ~1 TEU (11 t) with truck payload of 7 tonnes: $ 205.70	Total transport cost for ~ 1 TEU: ***$ 205.70***

2. Post dry port

Transport of breakbulk cargo by truck (20 km)

Transport of containers by rail (300 km)

Cargo origin/ destination — Dry port		Seaport
Truck operating cost, per tonne-km: : $ 0.15 Total cost to transport ~1 TEU (11 t) with truck payload of 7 tonnes: $ 33.00	Rail operating cost, per tonne-km $0.045 Total cost to transport 1 TEU (11 t) $149.95	Total transport cost for 1 TEU: ***$ 182.95***

Net saving in total transport cost per TEU (1-2): ***$22.75***

Conclusions from transport cost reduction estimates

- Financial cost reduction of $22.75 per TEU (11%) may be converted to Economic cost reduction by applying Shadow Pricing Factor to eliminate taxes and government charges

- Economic cost reduction would be of order of US$ 20 per TEU (using an SPF of 0.88)

- **BUT cost reduction will increase trade competitiveness of shippers using the dry port, possibly leading to increase in trade volume**

2.2 Reduction in environmental damage

- Dry ports make possible the diversion of cargo movement between trade sources and seaports from road to more environmentally sustainable modes of transport, i.e. rail or IWT
- Such a diversion will result in a net reduction of:
  - greenhouse gas emissions
  - noxious gas emissions
  - noise propagation
- Environmental benefits of rail in particular magnified by application of electric rather than diesel traction, but emissions may be transferred from trains to power generating sources
- Greenhouse gas (principally carbon) emissions may be calculated at the rate of 2.7 kgs per litre of diesel fuel consumed and valued at about € 13 per tonne
- Calculation of noxious gas emissions and noise propagation depends on measurement of exposed populations – problem of valuation

2.3 Increase in public safety

- Diversion of cargo traffic from road to rail or IWT will reduce accident **frequency** as well as accident **consequences**
- **Accident frequency** = no. accidents per unit of traffic e.g. accidents per million vehicle-km
- Saving in accidents measured as difference between road and rail accidents, each calculated in relation to frequency
- **Accident consequences:**
  - include deaths, injuries and property damage
  - may be calculated in terms of number per million vehicle-km
  - problem of valuation

2.4 Reduction in transport infrastructure maintenance cost

- Diversion of cargo traffic from road to rail or IWT will reduce the **cost of road infrastructure maintenance**
- Whether or not this is likely to be a significant benefit will depend on the magnitude of truck traffic withdrawn from road infrastructure, as result of diversion to rail
- World Bank Road Costing Model (version HDM-4) provides methodology for distributing road maintenance costs to individual road traffic segments (with trucks bearing higher share due greater axle loadings)
- Countries which use HDM Model will have access to local data on road maintenance costs

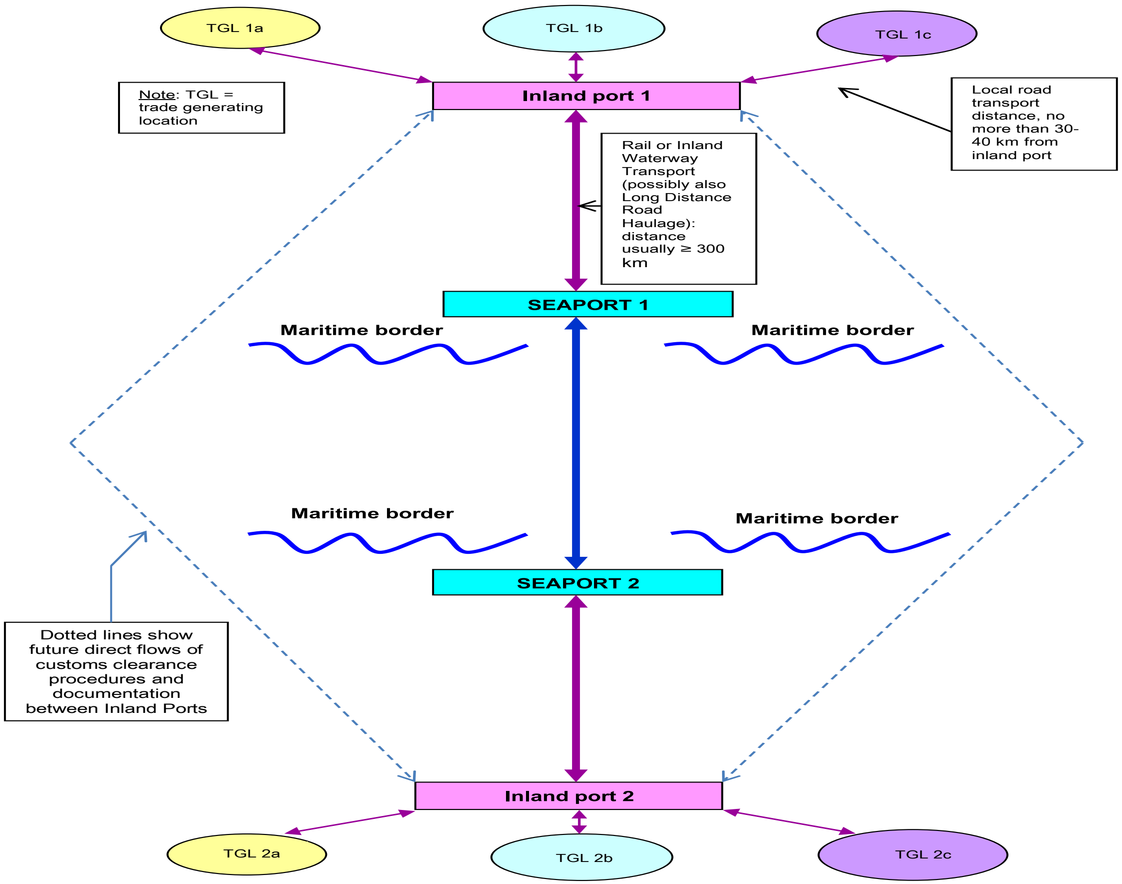
Item 3: Intergovernmental Agreement on dry ports

What is it?

A treaty, with following objectives:

- Promote and develop dry ports of international importance as part of international integrated intermodal transport and logistics system within Asia and between Asia and neighbouring regions
- Support identification and operationalization of international intermodal corridors
- Contribute towards achieving more sustainable transport sector

3.2 Concept of a regional dry port network



3.3 Implementation status

- Opened for signature Bangkok 7-8 November 2013
- Opened for signature New York 11 November 2013 – 31 December 2014
- Entered into force 23 April 2016, 30 days after requisite number of member states ratified, accepted, approved or acceded
- As at October 2020, 16 ESCAP member States had become parties to the Intergovernmental Agreement on Dry Ports

3.4 Guiding principles

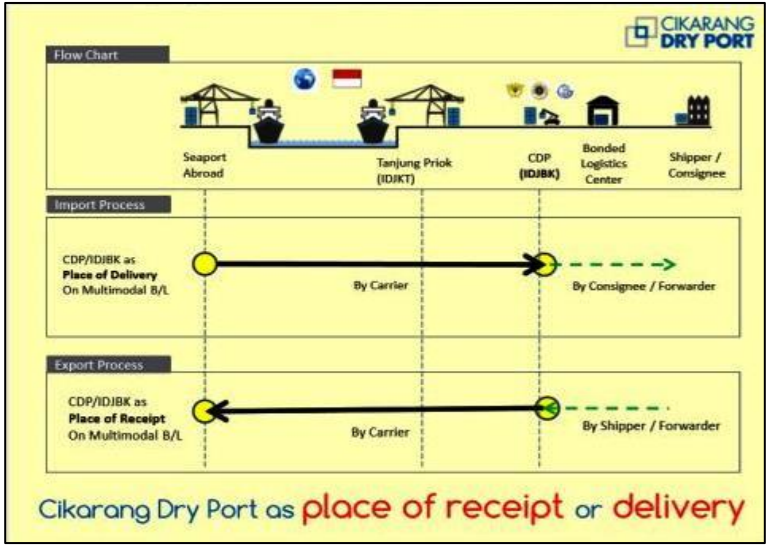
Annex II of the agreement sets out principles for guidance of member countries in developing and operating dry ports:

- Functions:
  - Basic: Handling, storage and regulatory inspection
  - Other: Receipt and dispatch, consolidation and distribution, warehousing, and transshipment
- Institutional, administrative and regulatory frameworks
  - Initiation of frameworks favourable to development and operation of dry ports
  - Designation of dry ports as points of origin or destination in customs docs
  - Ownership permitted may be public, private, or public private partnership
- Design, layout, capacity
  - Sufficient to support secure and smooth flow of cargo, containers and vehicles and to allow for expected future cargo and container volumes
- Infrastructure, equipment, facilities
  - Provision of infrastructure, equipment and manpower commensurate with existing and expected freight volumes (recommended list)

4. Enhancing border control functions

- *Interoperability of dry ports* within regional network requires that they have full range of functions (customs, quarantine and health) for border clearance of international cargo
- Implication: intermediate border checks and delays *should be kept to minimum necessary for border security* (possibly only a quick inspection of transport documents against cargo as reported on manifests)
- Desirably border inspection staff should be based permanently at dry ports or be available on demand to undertake inspections there
- To make border clearance functions of dry ports fully effective, necessary to:
  - integrate different processes and documentation under single window
  - provide border control staff with authority and IT tools (e.g. consignee profile data) to be able to undertake pre-clearance of consignments before arrival in dry port, or indeed in seaports

Example of successful initiative to strengthen trade through streamlined border procedures: Cikarang-Lard Krabang



1. All clearance formalities completed at dry ports (Cikarang and Lard Krabang)
2. Dry ports (Cikarang and Lard Krabang) specified as ODs on Multimodal B/L
3. Dry ports identified with UN/LOCODES on B/L – ID JBK (Cikarang) and TH LKR (Lard Krabang)
4. Bonded transfer to seaports under electronic seal

Content – Part 2

1. Policy initiatives to assist dry port development
2. Infrastructure issues related to dry port development
3. Good practices of dry port development in the region
4. Financing - PPP and other financing methods

Item 1. Policy initiatives to assist dry port development

Commonly applied initiatives

Description (Policy initiative)	Intention to support:			Remarks
	Establish-ment	Commence-ment of operations	Longer term financialvi ability	
Land transfer	√			Most benefit in short term
Tax waiver	√	√		Short term benefit
Priority development of transport connections	√	√	√	Vital benefit in short-long term
Incorporation into export processing or other FTZs		√	?	May have long term benefit (depends on location and market possibilities)
Regulation for sustainable transport connections		√	√	Will favour most efficient transport in longer term

1.1 Problems with policy formulation and application

- Generally fragmented authority for coordination and planning of dry port development in region – many separate agencies and regulatory authorities involved
- Limits ability to formulate and apply consistent and effective government policies and initiatives
- Need in majority of countries to set up inter-agency coordinating committee under single government authority, preferably Ministry of Transport or equivalent
- India and Islamic Republic of Iran provide good examples of countries which have succeeded in co-ordinating the dry port planning and regulatory functions of different agencies under a single ministry:
    - In India, functions co-ordinated within Inter Ministerial Committee under Ministry of Commerce and Industry
    - In Islamic Republic of Iran, functions of multiple agencies co-ordinated within inter-agency committee under the Ministry of Transport

1.2 Effectiveness of various policy initiatives

- Land transfer
  - Transfer of land from public sector to private sector made either as grant or lease or sale, at concessional rates
  - Often a pre-requisite for private sector investment in dry ports, due prohibitively high land prices (often fuelled by speculation)
  - Is usually a public sector obligation in PPP contracts
  - Highly effective in short term (establishing dry ports), but can also secure viability in longer term
- Financial incentives (e.g. tax waivers)
  - Can include business tax or land tax holidays, for limited period of time
  - Considered to be ineffective or at least of only short term benefit
  - Few countries have applied such incentives to assist dry port development, one exception being Australia, where local government land taxes are sometimes reduced to assist establishment of dry ports

1.2 Effectiveness of various policy initiatives (cont'd)

- Priority development of transport connections
  - Adequate connections of dry ports by road and rail, or (where possible) inland waterways, essential for their financial viability in short, medium and long term
  - In case of some PPP contracts, development of external transport connections an obligation of public sector partners
  - In some cases, governments assist infrastructure development through financial grants to private developers (e.g. branch-lines in Islamic Republic of Iran)
- Incorporation into export processing or other free trade zones
  - Application with mixed success
  - Often FTZs located near borders with limited, or no, industrial base – therefore limited, or no, demand for dry port services
- Regulation for sustainable transport connections
  - Most countries restrict truck weights and dimensions to limit road damage or enhance safety (not to divert traffic to sustainable transport modes)
  - Problems of enforcement and limited effect in terms of traffic diversion to sustainable modes
  - Some countries of the region (e.g. Australia and Tajikistan have actually relaxed truck weights and dimensions to encourage larger and more efficient trucks (these policies need to be reversed)

Item 2. Infrastructure issues related to dry port development

Key benefit of dry ports is reduction in logistics costs* of moving cargo from trade origins to trade destinations

- Can only be achieved if different transport modes can be utilized for parts of journeys which will minimize their operating costs, implying that:

1. Dry ports should be connected to cargo sources by short-distance road haulage services (either small break-bulk trucks for de-consolidated cargo or trailer trucks for containers)

2. Dry ports should be connected to seaports (or dry ports in other countries) by long-distance railway container haulage services

- Realization of transport efficiency and related cost savings will depend on dry ports being connected to high quality seaport, road and rail infrastructure

* Comprises all transport, handling and storage costs incurred between a consignment's origin and its destination.

2.1 Seaport Linkages

❖ An important function of dry ports: to facilitate access to the sea for land-locked countries and regions, by consolidating cargo and by providing cost effective land transport linkages to seaports

- Throughput and storage capacity of a seaport as well as capacity and efficiency of its cargo handling systems can have critical effect on growth of inland trade
- In case of some seaports (e.g. Chittagong), capacity is over-stretched
- In case of others (e.g. Shahid Rajaee) capacity is under-utilized
- Seaport managers have responded to capacity shortages in different ways, but most involve re-location of container stuffing/unstuffing outside of port
- Has sometimes led to re-location of congestion from port to highway system (case of Bangladesh)

2.1 Seaport linkages (continued)

Two problems associated with rail accesses to seaports:

1. Lack of adequate track length ***inside*** ports

- All seaports reviewed in UNESCAP studies have rail connections, but ***almost none*** can accomodate full length trains in loading/off loading sidings inside port boundaries
- Imposes on railway operators:
  - ➢ need to break up trains outside of the port before placement of wagons in loading/off loading sidings and to re-marshal trains outside of the port after retrieval of wagons from loading/off loading sidings **OR**
  - ➢ need to transfer containers by road trailer between rail terminal and port **(as is case with JNPT)**
- Either way, results in substantial additional operating time and cost **(not recoverable in railway charges)**

2.1 Seaport linkages (continued)

2. Poor location of rail tracks ***inside*** ports

- Few, if any, of the region's seaports locate rail sidings close to container stacks adjacent to berths (in most cases they are 500m to 2 km distant). ***Even BMCT*** (centralized rail terminal for JNPT) ***located 4km from most port container terminals***

- Results in multiple handling of rail-delivered containers (typically 3 lifts per container to/from stacks as compared with only a single lift for road-delivered containers) and a significant competitive disadvantage for rail

Need for port managers to commit to improving rail accesses to their ports!

2.1 Seaport linkages (continued)

Example of restricted rail access to a seaport

- Satellite image of a major seaport (container berths on left)
- Rail access line (purple) is 1.5 km from container berths
- Off-loaded containers must be transported from rail sidings by prime mover and yard trailer
- Other cargo piers (to right of the container pier) have railway sidings running their full length, off the access line

2.2 Road linkages

- **Dry ports need good quality local road linkages to cargo sources**
- In case of countries lacking a comprehensive rail network, dry ports also need access to seaports via multi-lane highways
- Asian Highway network appears to provide good coverage of region’s dry ports
- No “missing links” in AH network preventing seamless transport between dry ports and seaports, or between dry ports in regional network, identified
- Upgrading of primary road links between seaports and inland trade generating centres recently undertaken in several countries of region (mostly involving extra lane construction)
- However, limited road capacity persists in some countries, particularly those located in mountainous areas (e.g. Afghanistan, some countries of Central Asia, and southwestern China)

2.2 Rail linkages

- Rail linkages to dry ports exist in most countries of the region
- Coverage of Trans Asian Railway network now quite extensive
- Several "missing links" eliminated over past decade, particularly in Islamic Republic of Iran
- But several more have since arisen, as result of :
  - development of new seaports (e.g. Chabahar on Gulf of Oman in Islamic Republic of Iran); and
  - creation of new rail transit corridors (e.g. between southwestern China and Islamic Republic of Iran)
- Upgrading of existing TAR links undertaken, to increase route capacity through track doubling and signalling improvements, on some lines linking inland centres with seaports (e.g. Dhaka-Chittagong line, Bangladesh)
- Future track capacity expansion planned for key TAR routes connecting Bandar Abbas (Shahid Rajaee Port) in Islamic Republic of Iran with Tehran and Sarakhs
- Special case is development of **Dedicated Freight Corridor in India**

3. Good practices of dry port development in region

- Good location: selection of dry port site close to trade sources, but remote from seaports

  - ➢ Proposed Aprin Dry Port will be within 20-60 km road haul of industries accounting for 60% of Iranian container volume, but about 1400 km by rail from Shahid Rajaee Port (Bandar Abbass)

- Efficient layout: design of centrally located railway sidings, facilitating arrival and departure of full length container trains in and from dry port, complemented by internal roads allowing unimpeded circulation of trucks and handling equipment

  - ➢ Examples are Lard Krabang ICD (Thailand) and Whitefield ICD (India)

- Efficient trading and border control practices: (i) specifying and facilitating border clearance within dry ports (avoiding delays in seaports); (ii) adoption of UN/LOCODES; designating dry ports as points of origin and destination in transport documents (such as Multimodal Bill of Lading)

  - ➢ Examples are Lard Krabang ICD (Thailand) and Cikarang Dry Port (Indonesia)

Example of good rail access planning: Lard Krabang Dry (Thailand)

- Rail loading/unloading tracks centrally located, permitting working of handling equipment (reach-stackers) on either side

- Tracks are one km long, permitting full length trains (loco plus 30-40 wagons carrying 60-80 TEU) to arrive and depart directly in/from the terminal

4. Financing - PPP and other financing methods

- Three main options:

  Option 1: Financing by public sector; operation by public sector, or outsourcing of operation through management contract with private sector

  Option 2: 100% private sector financing and operation

  Option 3: Public Private Partnership (PPP) variants

- Risk assignment:

  - Under Option 1 (applied to Khorgos project in Kazakhstan): all risk assumed by public sector. Applied within India to CONCOR.
  - Under Option 2 (applied in Australia and Indonesia): all risk assumed by private sector - may be unattractive to potential investors
  - Under Option 3 (only two applications to existing dry ports. Uiwang, Republic of Korea and Lard Krabang, Thailand): capital investment and risk shared in varying proportions between public and private partners

4.1 PPP variants

- All PPP schemes involve 100% private operation and shared public private investment; risk also shared
- Most involve transfer of land by public partner to joint venture
- Most also involve 100% of infrastructure investment by public partner and 100% of equipment investment by private partner, but possible for infrastructure investment to be shared by public and private partners
- So far in region PPP mainly applied to highway and seaport projects with guaranteed level and stability of demand; high level of risk associated with dry port projects due to uncertain level and stability of demand, particularly in inland areas
- May be need for public sector to assume majority of risk to encourage PPP; in case of Lard Krabang project, PPP scheme successful because public sector covered all of project's infrastructure costs, in addition to providing land

4.2 Conclusions on ownership and financing options

- 100% state ownership and financing unlikely to succeed owing to state budget shortfall
- 100% private ownership and financing unlikely to be attractive to potential investors owing to excessive risk
- PPP likely to succeed if state assumes a major part of risk (through transfer of land and investment in all infrastructure)

Content – Part 3

1. Broad principles
2. Key principle for CY design: good rail access
3. Road access
4. Customs security
5. Container yard (CY) design and operation

Item 1. Broad principles

- **Not necessary for dry ports to have identical design standards to function effectively as inter-related components of regional network**
- But, there is need for **some consistency** among them as to basic services offered and design of infrastructure needed to provide these services

Basic services:

- Handling, consolidation, storage and modal transfer of containers and cargo;
- Customs and other border control inspection and clearance of international cargo

Basic infrastructure needs:

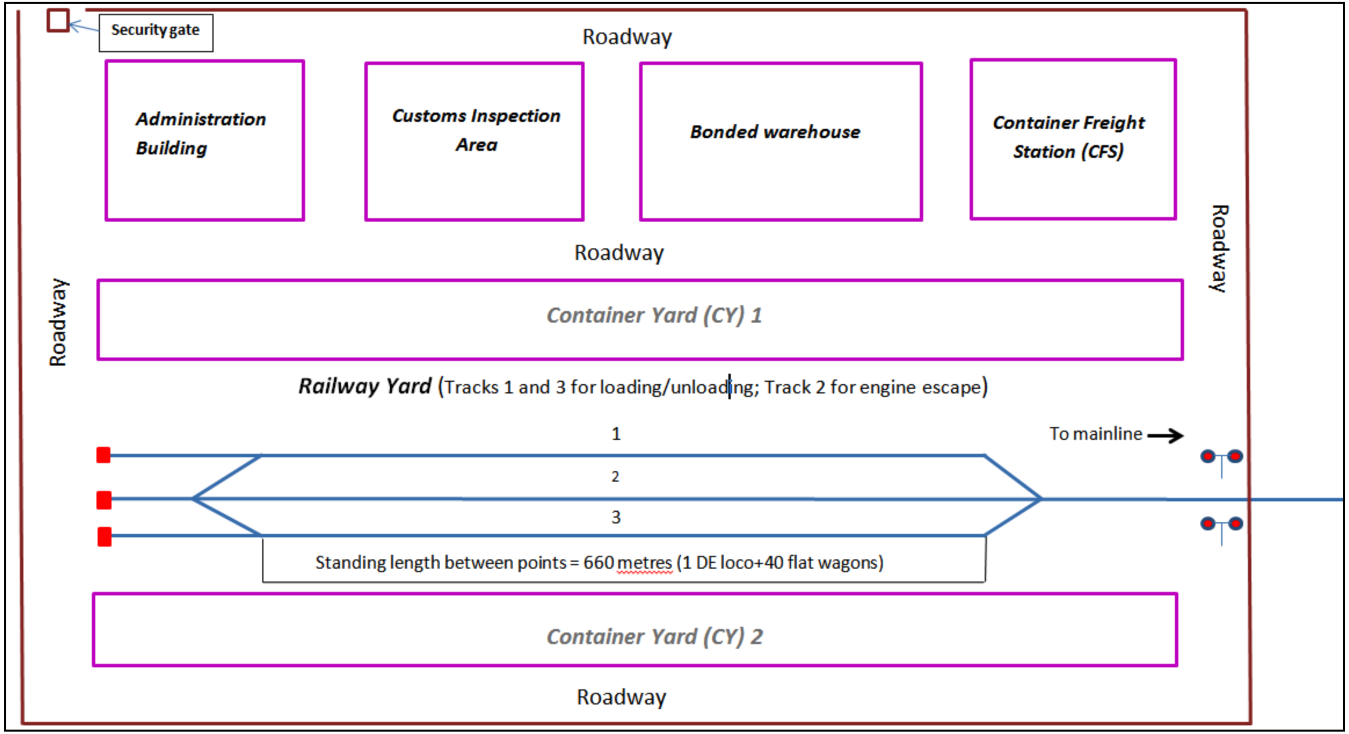
- Fenced customs secure area - segregated entry/exit points for different traffic;
- Container Yard (CY) – receipt/despatch of containers by road and rail, container storage;
- Container Freight Station (CFS) for loading/discharge of cargo to/from containers;
- Customs inspection area where cargo may be discharged for inspection;
- Bonded warehouse for storage of break-bulk under bond cargo
- Administration building (dry port management, customs, freight forwarders)

Item 2: Key principle for CY design: *good rail access*

Rail infrastructure to be provided inside a dry port should allow receipt and despatch of **full length unit container trains** running between **a single origin and a single destination**, without need to be broken up or re-marshalled outside the dry port

- ***CY should be designed around rail access and not the reverse***
- Loading and unloading of trains would take place in centrally located sidings comprising **at least** three tracks – loading, unloading and locomotive release
- Actual number of tracks depends on forecast traffic volumes
- For a reach-stacker served facility, container stacks of CY located either side of the tracks (to allow for separation of import and export containers and for loading and unloading on both sides at a time)
- Paved area of CY on which stacks rest would extend entire length of tracks

2.1 Possible layout of dry port (reach-stacker served terminal)



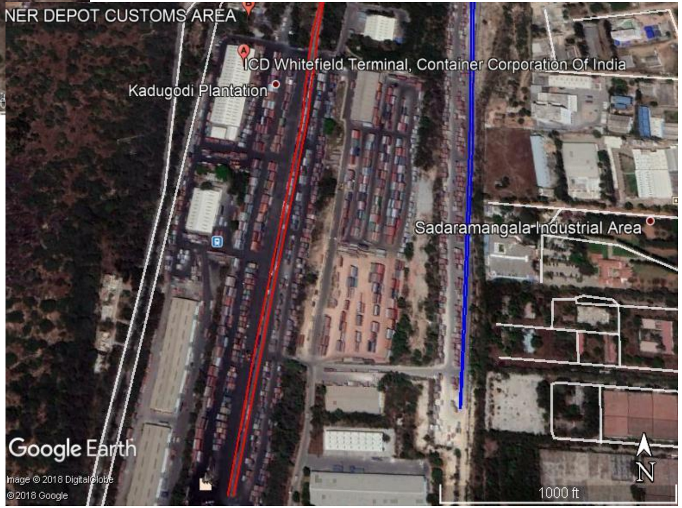
Example of good rail access planning (1): Lard Krabang ICD (Thailand)

- Rail loading/unloading tracks centrally located, permitting working of handling equipment on either side

- Tracks are one km long, permitting full length trains (loco plus 30-40 wagons carrying 60-80 TEU) to arrive and depart directly in/from the terminal

Example of good rail access planning (2): Whitefield ICD (India)

- Rail access directly from/to Bengaluru-Chennai mainline
- 2 access tracks, one each serving export/import container stacks and domestic container stacks
- 2 loading/unloading tracks in each section (900 m long = 62 x 2 TEU wagons; actual/train = 45 x 2 TEU)



- Loading/unloading tracks placed centrally between container stacks
- All lifting (trains and stacks) by reach-stacker
- Annual handling capacity (estimated by consultant): 232,000 TEU
- Electric traction (approach track to sidings is wired)

Example of good rail access planning (3): Uiwang ICD (Rep.Korea)

<u>Terminal 1</u>

- Rail access directly from Uiwang Marshalling Yard
- 3 access tracks each switched into 3 loading/unloading tracks of about 570 m length
- Trains of 30x2 TEU and 20x3 TEU wagons

- Loading/unloading tracks placed centrally between container stacks
- Trains loaded/unloaded by RTGs; reach-stackers work stacks
- Annual handling capacity (2 terminals): 1.37 million TEU

2.2 Planning for track length and number

Track length

- Length of loading/unloading tracks determined by number and length of wagons comprising a train
- For a train of 40 container wagons pulled by a single locomotive, length = 1 loco x 22 m + 40 wagons x 14.45 m + 10% allowance for braking and loco release = 660 metres approx.
- Length should not be planned for current train lengths, but for **likely future economic lengths**, based on advice from railways

Number of tracks

- Required number of loading/unloading tracks determined on basis of forecast container handling volume, number of trains operated and average train turnaround times
- To this number must be added an additional track for release of locomotive(s)

2.3 Influence of traction type on track layout

- Figure presented illustrates layout applying for a diesel hauled train, whereby the train may be hauled directly into and out of the sidings by the train locomotive (which uses a “free track” to reverse to the other end of the train)
- In limited number of cases where electric traction employed, **will be necessary to construct reversing tracks outside dry port boundary** to allow electric locomotives to re-position to end of train and push into sidings inside dry port
- This is necessary to avoid interference of electrical catenary with high rise container handling equipment operating inside terminal
- In this case only first 30-40 metres of siding track would need to be electrified

2.4 Choice of track construction type and axle load

- Except for two lengths of ballasted track, containing points and crossings, or switches, at either end of the rail yard, loading/unloading tracks should be embedded in the pavement to allow for ease of reach-stacker working
- Design axle load in rail yard should be compatible with that of the mainline railway network
- For metre gauge railways this is now typically 20 tonnes, while for wider gauge railways it is typically in the range of 22.5-25 tonnes
- Even at lower level, axle load sufficient to accept heavy axle load locomotives and wagons carrying two fully loaded 20ft containers or a single 40 ft container

Item 3. Road accesses

- Road connections to dry port will be via slip roads off local or national highway system
- In most cases, connections provided by responsible road infrastructure authorities (local or national highway agencies
- Road connections should be suitable (in terms of pavement condition, alignment, load bearing and gradient) for container and break-bulk trucks conveying containers or break-bulk cargo between cargo sources and the dry port

Item 4. Customs security

- **Whole of dry port will be customs secure area**

- Will need to be fenced in accordance with local Customs Agency regulations

- Where there is to be provision for handling other types of cargo in addition to containers, there needs to be separate working areas and security accesses or gates for each

- **Explains why it is generally uneconomic to handle multiple cargo types within a dry port**

5. Dry port design and operation

5.1 CY layout determined by choice of handling system

- Layout depends on number and length of rail siding tracks as well as type of handling system to be employed
- Choice of container handling system (**reach-stacker** or **portal crane** system- in some cases straddle carrier system?) will in turn depend on expected volume of containers to be handled:

Reach-stacker:

- ➢ has wide turning circle, is therefore land area intensive, and has slow handling rates (**typically only 12-15 lifts per hour**).
- ➢ advantage is a low capital cost, ranging from US$ 500,000 (for an Indian manufactured Hyster unit) to US$ 800,000 (for a new Kalmar unit)

Portal crane system, either a **rail mounted gantry (RMG)** or a **rubber tyred gantry (RTG)**, crane:

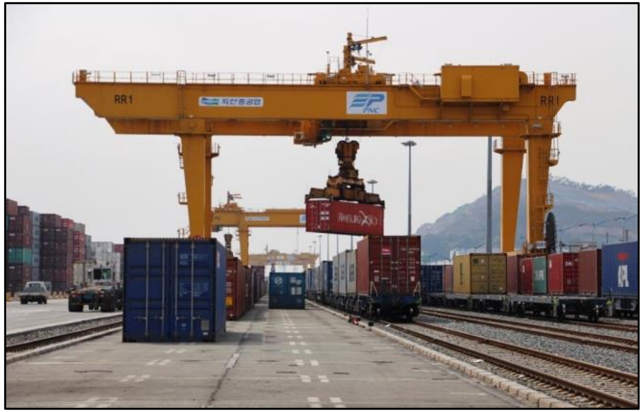
- ➢ can accomodate denser stacking of containers, is therefore less land area intensive, and has fast handling rates (**typically 20-30 lifts per hour**)
- ➢ disadvantage is a high capital cost (about US$ 1.6 million for an RTG and US$ 2.6 million for an RMG

- In general reach-stacker suitable for throughput volumes up to 200,000 TEU p.a., but this system is now handling nearly 465,000 TEU p.a. of rail-hauled containers at Lard Krabang
- Owing to much higher cost, portal crane systems are justified for throughputs in vicinity of 1.0 million TEU p.a.

Pictures of container handling systems

Reachstacker in operation, India

RTG transferring containers rail to road, ROK



RMG discharging containers from rail, ROK

Straddle carrier moving containers rail to stack, Bangladesh

5.2 CY layout, capacity and pavement design

For a reach-stacker served terminal

- Two CY sections placed either side of loading/unloading tracks to separate import and export containers
- At least two reach-stackers will work one train at a time (working along the length of the train), lifting containers directly between wagons and container stacks in one of 2 CY sections, **avoiding need for trailer transfer**
- With increase in number of reach-stackers, **loading/unloading can be done simultaneously on both sides of the tracks** (i.e. simultaneous handling of import and export containers)
- In each CY section, container stacks will be arranged in blocks of about 4 TEU wide, 3 TEU deep and 3-5 TEU high, along the length of tracks, each separated by a width of 13 metres to allow for reach-stacker turning circle. Storage capacity = 1,300 TEU approx.
- Annual throughput capacity depends on number of times CY storage volume is turned. **In this case average dwell time of a container cannot exceed 4.5 days for throughput of 100,000 TEU**
- To minimize capital cost, CY can be constructed in flexible paving materials, but will have to withstand heavy wheel loadings of container lifting equipment (reach-stacker lifting 45 tonnes = 25 tonnes per wheel).

5.2 CY layout, capacity and pavement design (continued)

For a portal crane served terminal

- Container stack arranged in a single block along the length of the loading/unloading tracks
- Crane will straddle at least the tracks and a roadway and possibly even the container stack as well (**to allow container transfers between rail and road and between rail and stack as well**)
- Cranes will need to run up and down the length of the train on rails or rubber tyres as the case may be
- To minimize capital cost, CY can be constructed in flexible paving materials, but will have to be strengthened for heavy loading under the runway of the portal crane(s)
- Wheel loadings for an RTG are approximately 26-35 tonnes

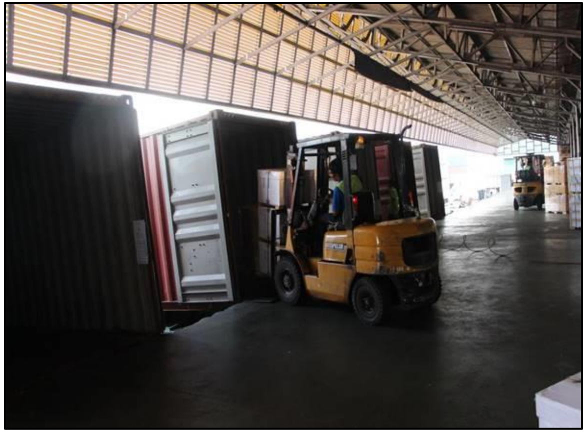
5.3. Provision for truck circulation within dry port

- Efficient operation of dry port depends on unimpeded circulation of trucks throughout most of dry port area
- Exception is intersection with rail access line, which needs to be protected by automatic level crossing barriers and warning devices
- Internal roads should be constructed with width of 15 metres, to allow handling equipment and trucks to pass safely

5.4. Container Freight Station (CFS) design and operation

- Function of CFS is to pack and unpack cargo into and from containers which are moved to and from CY
- Will not include all containers handled in CY, as some containers moved outside dry port for packing and un-packing at shipper/consignee premises
- CFS should be designed with container bays facing onto a raised loading/unloading platform on one side and truck loading/unloading bays on the other
- Containers packed and unpacked by forklift trucks while still on their trailers (see picture)
- Similarly break-bulk trucks loaded and unloaded from raised platform by smaller forklifts (2-3 tonne capacity)
- Area required for CFS may be calculated on basis of some proportion of loaded import and export containers in CY moving through CFS
- Floor area of cargo discharged from these containers calculated by applying to TEU volume an average area per TEU of 30 square metres, traffic circulation factor of 1.3, and a seasonal traffic peaking factor

CFS operations



Forklift loading cargo into container (Thailand)

Forklift loading cargo onto break-bulk truck (Thailand)

5.5. Other building area requirements

- Other buildings within the dry port are:
  - **Administration building,** accomodating dry port management, customs and other border inspection officials, freight forwarders and banking and financial services
  - **Bonded and long term warehouses**
  - **Security gate office**
  - **Customs inspection facility**
  - **Workshop**
- Area requirements for these can be determined from consultation with customs and potential warehouse operators
- Warehousing area in particular can vary in line with the scale of demand – if commercial warehousing services are to be provided, building requirements could be substantial

5.6. Terminal management IT system

- Essential for entry, exit and placement into storage of containers and cargo to be tracked by a real time computer system
- Should be possible to locate any container or cargo consignment from time of departure from seaport or from shippers premises to arrival in dry port and placement into storage
- Computerized yard control system should be used to determine with precision where a container is to be placed within stack

THANK YOU

WWW.UNESCAP.ORG

UNESCAP
UNESCAP
UNESCAP
UNITEDNATIONSESCAP
UNITEDNATIONSESCAP

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific