Republic of India
Chennai Port Trust

The Project
on
Improvement of Chennai Port Operation
（Phase II）

Final Report

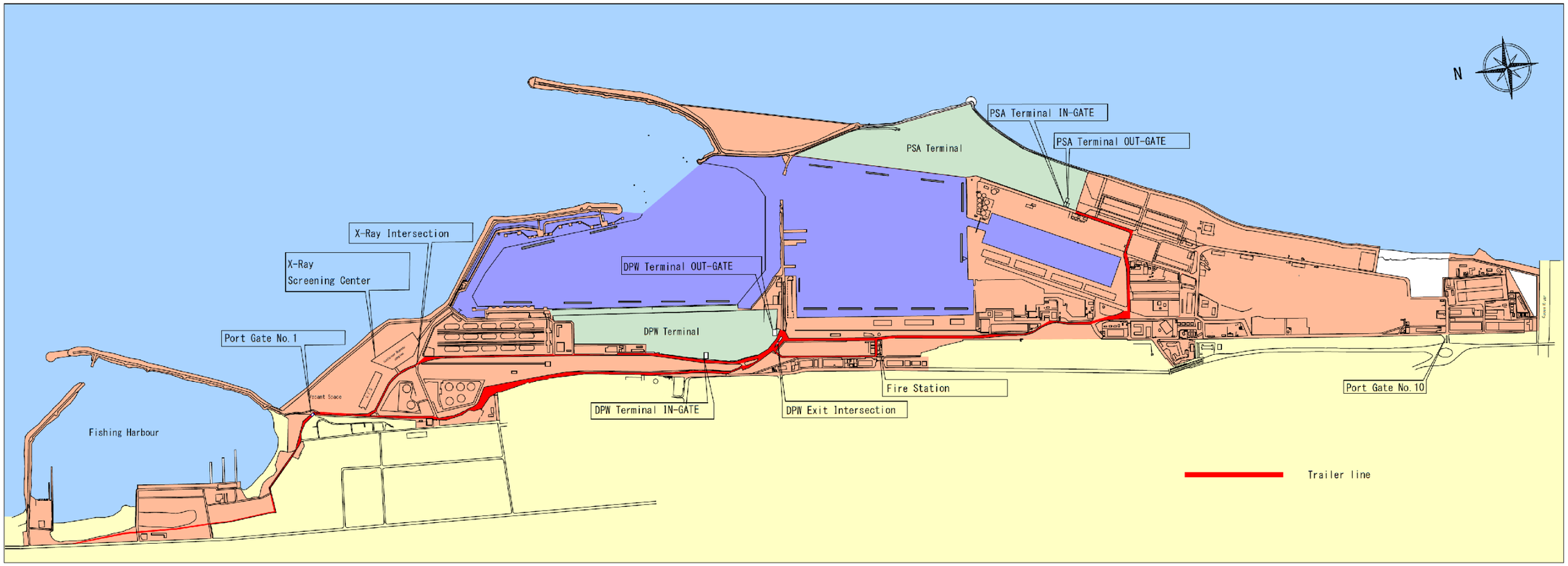
January 2018

Japan International Cooperation Agency

The Overseas Coastal Area Development Institute of Japan
Mitsui Engineering & Shipbuilding Co., Ltd
Hakata Port Terminal Co., Ltd

Chennai port and its hinterland

Layout of Chennai port



List of Abbreviations and Terminology

Abbreviation	Description
CBIC	Chennai-Bangalore Industrial Corridor
CCTL	Chennai Container Terminal
CFS	Container Freight Station
CHA	Customs House Agent
ChPT	Chennai Port Trust
CISF	Central Industrial Security Force
CITPL	Chennai International Terminals Pvt. Ltd.
CONCOR	Container Corporation of India Ltd.
CWC	Container Warehousing Corporation
DPW	DP World. One of the global terminal operators
DRF	Delivery Request Form
FORM 13	FORM 13 1) Export FORM13 2) Import FORM13
HEP	Harbor Entry Permit
HiTS	Hakata Port Logistics IT System
ICD	Inland Container Depot
IIT	Indian Institute of Technology (Madras)
JNPT	Jawaharlal Nehru Port Trust
MOS	Ministry of Shipping
NACCS	Nippon Automated Cargo and Port Consolidated System
NACFS	National Association of Container Freight Station
NUTS	Nagoya United Terminal System
OOG	Out Of Gauge (Cargo)
PDCA	Plan-Do-Check-Act
PPP	Public Private Partnership
PSA	PSA International. One of the global terminal operators
RFID	Radio Frequency Identification
RO/RO	Roll On/Roll Off
Sagarmala	The Sagarmala is a policy initiative formulated in 2016 by the Government of India. The overall objective of the project is to evolve a model of port-led development, whereby ports become a major contributor to the country‘s GDP.
S/C	Steering Committee
TEU	Twenty Feet Container Equivalent Unit
TOS	Terminal Operating System

-Summary-

Contents (Summary)

Chapter.1 Background and Purpose of the Project

1-1. Background of the Project

(1) Present status in and around Chennai Port

Chennai Port is located in the northern part of Tamil Nadu state in close proximity to South- East Asia. Thanks to its locational advantage, a variety of industries such as the automobile industry, machinery industry, electrical and electronic industry, etc. have located there. Many Japanese companies have also expanded their businesses to this area. The number of Japanese companies with operations in Tamil Nadu state is 583 as of January 2017, the second largest in India.

(2) Present status of Chennai Port

Chennai Port plays a strategic role in marine transportation to Far East Asia and South East Asia. Many Japanese companies are located in the vicinity of Chennai area; therefore Chennai Port plays a vital role for the Japanese companies.

On the other hand, Chennai Port has some serious problems which are derived from it being an old port adjacent to a large city. Heavy congestion of container trailers inside and outside the port has a negative impact on the region's economy. Furthermore, low-use areas exist inside the port and cargo handling efficiency is low due to narrow spaces behind berths.

(3) Technical Assistance by JICA

Based on the circumstances above, JICA conducted "the Project on Improvement of Chennai Port Operation" (hereinafter referred to as "Technical Assistance Phase I") from July 2014 to September 2016; the counterpart agency was Chennai Port Trust (ChPT). This technical assistance project was conducted in order to improve overall port operation, particularly by focusing on measures to alleviate traffic congestion.

In this project, a variety of activities conducted such as grasping the congestion status, analyzing congestion, utilizing IT technology and sharing information among stakeholders, and so in collaboration with ChPT and concerned organizations.

(4) Remaining issues and challenges

Many positive outcomes were generated through Technical Assistance Phase I. For example, the congestion status outside the port has been improved, transaction time at Port Gate No.1 has been shortened and lead time from CFSs to Port Gate No.1 has been reduced. However, because ChPT does not have sufficient experience to tackle difficult issues such as information sharing utilizing IT related technologies by themselves, technical assistance is still required in order to improve and modernize port operations.

Furthermore, as Kamarajar port, Kattupalli port and other ports located near Chennai Port have been upgrading their facilities, Chennai Port needs to not only improve operational efficiency but also modernize its facilities in order to remain competitive. ChPT requested a study on the improvement and development of port facilities.

Based on the background mentioned above, the Project on Improvement of Chennai Port Operation Phase II (hereinafter referred to as "the Phase II project") has been conducted.

1-2. Purpose of the Project

The purpose of this Project (which is a continuation of the Phase I project) is as follows.

i) To enhance the efficiency of the operation of Chennai Port by reducing container movement lead times through following up the activities taken in Technical Assistance Phase I and entrenching congestion alleviation measures to the counterpart agency (ChPT).
ii) To examine the validity and effectiveness of possible port infrastructure projects (including IT related projects) through collecting and analyzing relevant information and data.

1-3. Areas of the Project

Chennai Port and its surrounding area

1-4. Counterpart and Implementing Agencies

Counterpart	Chennai Port Trust (ChPT)
Central Government	Ministry of Shipping (MOS)
State Government	Tamil Nadu State
Concerned Organizations	Chennai Chapter of National Association of Container Freight Station (NACFS), Central Warehouse Corporation (CWC), Customs (CBEC: Central Board of Excise and Customs), Central Industrial Security Force (CISF), Trailers Association (Owners and Drivers), etc.

Chapter.2 Team Members and Dispatch Schedule

2-1. Composition of the Team

The JICA Study Team (hereinafter referred to as "The Team") was composed of the following members.

Assigned Area	Name	Organization
Leader／Port Planning	Akira KOYAMA	The Overseas Coastal Area Development Institute of Japan (OCDI)
Modernization of Port Facility (1)	Ryuichi KUWAJIMA Takahiro SUZUKI (from July 2017)	OCDI
Modernization of Port IT System (1)	Norihiro FUKAZAWA	Mitsui Engineering & Shipbuilding Co., Ltd.
Modernization of Port IT System (2)	Hiroshi KIMOTO	Hakata Port Terminal CO., Ltd.
Modernization of Port Facility (2)	Osamu KUNITA	OCDI
Environmental and Social Considerations	Shane REID	OCDI
Traffic Survey	Eiji HASEBE	OCDI
Modernization of Port Facility (3) / Administrative Coordinator	Yoshikazu OSHIKAWA	OCDI

2-2. Dispatch Schedule of the Team

Dispatch schedule of the Team up to the first half of the Phase II project is shown below.

Dispatch Number	Schedule
First（Ninth）Dispatch	Sunday, 12th February – Saturday, 11th March, 2017
Second（Tenth）Dispatch	Sunday, 23rd April – Saturday, 20th May, 2017
Third (Eleventh) Dispatch	Sunday, 23rd July – Saturday, 19th August, 2017
Fourth (Twelfth) Dispatch	Tuesday, 10th – Tuesday, 31st October, 2017
Fifth (Thirteenth) Dispatch	Sunday, 3rd – Sunday, 10th December, 2017

Note: Number in parenthesis means the total number of dispatches from the Phase I project. This number is used in this report. Dispatch schedule includes traveling days. Schedule of each member may vary.

Note: The 5th dispatch was not scheduled in the original dispatch plan. Two (2) team members (the Team Leader and the member in charge of IT System Improvement (1)) were dispatched for eight (8) days in order to submit the revised draft final report and the Team's reply to comments from ChPT. The two members also reported the results of this study to Japanese companies stationed in Chennai.

Chapter.3 Major Activities and Results

3-1. Outline of Project Activities

The entire activities planned during the Phase II project and the relation between the Phase I and Phase II projects are as follow.

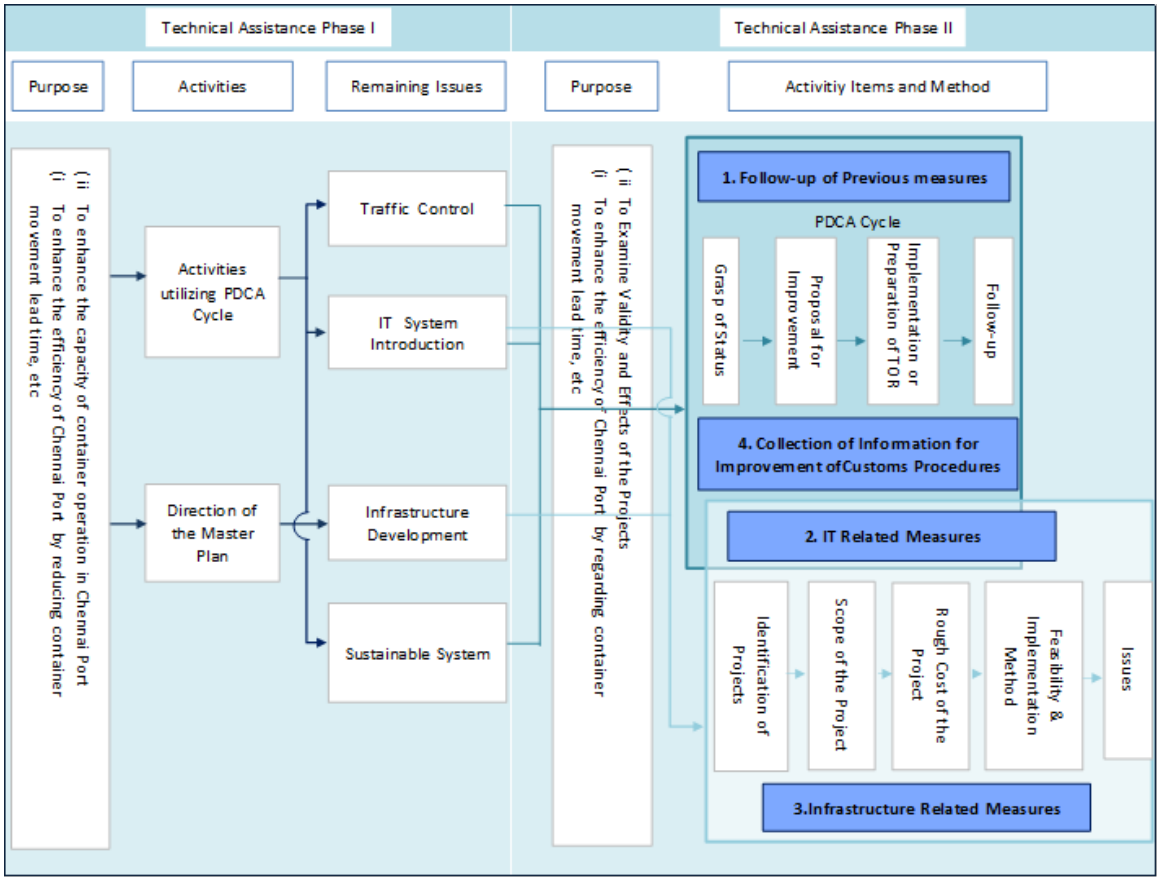


Figure 3-1 Entire Activities planned during the Phase I project

(1) Follow-up of Previous Measures for Improvement of Port Operation

The Team has been following up the several surveys and activities conducted during the Phase I project for further optimization of the flow of trailers. The Team has also been supporting the measures to be conducted by ChPT and regulatory authorities concerned.

The Team has continued to conduct these surveys and activities after observing each site again and making the necessary modifications when circumstances have changed.

(2) Modernization of Port Operation I (IT related Measures)

The utilization of IT is essential for modernizing Chennai Port operations. The Team has continued to promote the introduction of a system utilizing IT, as it contributes not only to the alleviation of the traffic congestion but also to the operational improvements of the whole Port.

(3) Modernization of Port Operation II (Infrastructure related Measures)

The Team has been examining measures on how to improve and develop port facilities for modernization of Chennai Port. In addition, ChPT requested the Team to examine the priority of the projects which the Team proposed in the Phase I project. The Team has continued to examine the priority and feasibility of the projects based on the previous discussions with ChPT.

(4) Collection of Information for Improvement of Customs Procedures

The Customs procedure for import/export containers is one of the important issues for alleviating the traffic congestion at Chennai Port. Therefore, the Team has continued to grasp the Customs procedure inside and outside Chennai Port through observation and interviews, identify issues, examine improvement plans, and implement them through ChPT when possible.

3-2. Steering Committee

The Team has continued to support ChPT in holding a Steering Committee (S/C). Date and agenda of the previous S/C are as follows.

1) S/C of the 9th dispatch was held on Friday, February 17th, 2017 at the Board Room of ChPT with attendance of the Chairman, Deputy Chairman and Official of ChPT and representatives of concerned organizations. The Team explained the policy and contents of the technical assistance Phase II.

2) S/C of the 10th dispatch chaired by the Traffic Manager was held on Thursday, May 18th, 2017 at the Board Room of ChPT. Officials of ChPT and representatives of concerned organizations attended the S/C. The Team explained the progress of the study on Improvement of Chennai Port Operation Phase II.

3) S/C was held on Thursday, August 17th 2017 at the Board Room of ChPT. Officials of ChPT and representatives of concerned organizations attended the S/C. The Chairman of ChPT chaired the meeting. The Team explained the progress of the study on Improvement of Chennai Port Operation Phase II.

4) A Steering Committee (S/C) was held on Thursday, October 26th 2017 at the Board Room of ChPT. Officials of ChPT and representatives of concerned organizations attended the S/C. The Deputy Traffic Manager of ChPT chaired the meeting. The Team explained the progress of the study. Participants remain keenly aware of the necessity to address the congestion issues in cooperation with related organizations.

3-3. Exchange of Opinions with the Ministry of Shipping

The Team called on the office of Mr. Saran, Deputy Secretary of the Ministry of Shipping in Delhi on Tuesday, February 28th 2017. The Team explained the positive outcomes of the Phase I project and the policy and contents of the Phase II project. Mr. Saran requested that further efforts be made to

reduce congestion. He also stated that it was necessary to persuade stakeholders to cooperate fully with measures taken to combat congestion. On the other hand, regarding the projected decrease in traffic volumes in the Sagarmala Report, he said the Ministry of Shipping would continue to regard Chennai Port as an important major port.

3-4. Discussion on the Reports

(1) Discussion on the Interim Report

A meeting to discuss the Interim Report was held on Saturday, August 5th 2017 at the Board Room of ChPT. The Chairman of ChPT, the Deputy Chairman, Traffic manager, Chief Engineer, Deputy Conservator and other officials of ChPT (12 members in total) attended the meeting. The Chairman of ChPT chaired the meeting. The Team gave a presentation on the Interim Report of the Phase II project and discussed the contents of it in detail with participants.

(2) Discussion on the Draft Final Report

A meeting to discuss the Draft Final Report was held on Tuesday, October 24th 2017 at the Board Room of ChPT. The Chairman of ChPT, Traffic manager, Chief Engineer, and other officials of ChPT (8 members in total) attended the meeting. The Chairman of ChPT chaired the meeting. The Team gave a presentation on the Draft Final Report of the Phase II project and discussed the contents of it in detail with participants.

(3) Submission of the Revised Draft Final Report

The Team submitted the Revised Draft Final Report and the Team's reply to the comments from ChPT. The Revised Draft Final Report was submitted to the Chairman, Deputy Chairman, Traffic Manager, and Chief Engineer, etc. respectively. Some executives of ChPT stressed that ChPT would continue to examine certain projects in order to obtain JICA's assistance under the strong leadership of the Chairman.

(4) Explanation of the outcomes of the study to Japanese companies

The Team reported the results of the study to Japanese companies in Chennai on Monday, 4th December 2017. As this was the final dispatch, the Road and Port Infrastructure Committee of the Japan Chamber and Commerce in Chennai hosted an explanatory meeting and the Team explained the contents of the activities and the outcomes of the study. The members of the committee appreciated the efforts of the Team and expressed their expectations that ChPT would make continuous efforts to improve their port operation.

3-5. Following-up of the Technical Assistance (Part 1)

3-5-1. Port Activities

(1) Cargo handling trends

The total handling volume increased from 2007 to 2010 but has shown a tendency to decline since 2011. However, among major cargoes, container cargo is stable and its proportion to the total handling volume has also been increasing; containers accounted for 57.0% of the total cargo in 2014, 60.3% in 2015 and 57.5% in 2016. Handling volume of P.O.L is stable, while cargo handling of coal and iron ore has been suspended due to environmental concerns and the government's embargo on exports.

Table 3-1 Major Cargo Handled at Chennai Port

(IN '000 Tones)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
P.O.L	12,794	13,112	13,425	13,882	13,295	13,425	12,784	12,736	11,890	13,597	6,222
IRON	10,815	8,247	7,882	2,176	97	52	0	146	0	0	0
Fertilizer	882	761	591	776	633	421	415	541	260	268	168
Coal	3,990	4,684	3,362	2,503	961	0	0	0	0	0	0
Container	18,049	20,581	23,476	29,421	30,075	29,708	28,330	29,945	30,210	28,850	11,970
Other	10,624	10,106	12,321	12,702	10,646	9,798	9,576	9,173	7,700	7,499	6,058
Total(Tons)	**57,154**	**57,491**	**61,057**	**61,460**	**55,707**	**53,404**	**51,105**	**52,541**	**50,060**	**50,214**	**24,418**

Source:2007-2016;Indian Ports Association
2017;Chennai Port Trast HP
Supplement:2007(Apr 2007 to Mar 2008)
& 2017(Apr to Sep)

(2) Container handling trends

Container handling volume of Chennai port for the last four years has been fluctuating at around 1.5 million TEUs. In FY 2015, the handling volume reached a maximum of 1,557 thousand TEUs. However, the volume decreased to 1,485 thousand TEUs in FY 2016. In the first half of FY 2017, the volume increased by 5.5 % compared to the same period of the last fiscal year.

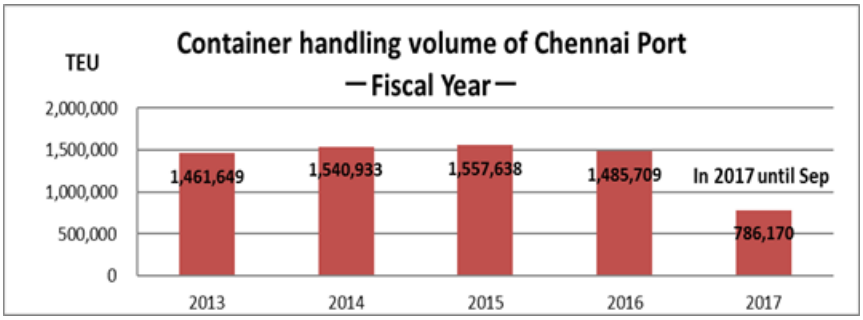


Figure 3-2 Container Handling Volume at Chennai Port (Fiscal Years (FY) base)

There are three container handling ports in the northeastern area of Tamil Nadu state and each is located in close proximity to one another. Container demand in the entire Chennai area has recently been increasing. Total number of handling containers reached 1,833 thousand TEUs in FY 2016 which represents an annual growth rate of 7.8% for the last three years. Container handling volume of

Chennai port is stable at about 1,500 thousand TEUs while that of Kattupalli port has rapidly increased and reached to about 300 thousand TEUs in FY 2016. The increase in container demand in this area seems to be being captured by Kattupalli port.
On the other hand, Kamarajar container terminal commenced its operations in early July 2017, but no container ship has called by the end of October.

3-5-2. Port Congestion Survey

(1) Regular congestion survey

The Team conducted a daily traffic congestion survey outside the port at each dispatch. The survey consisted of recording the number of queuing trailers as well as identifying the ending point of the queue and observing the status of TVT-Parking.

The general tendency of the status of congestion outside the port obtained during the Phase I project was that congestion was heavier from Wednesday and reached a peak at the weekend. Congestion became slight from the afternoon of Sunday to Monday and then became gradually heavier from Tuesday. However, a specific tendency such as the above was not observed during the Phase II project. The reasons for the lack of a clear tendency are thought to be changes in the container handling volume rate between CTL and CICPL, changes in calling schedule of container vessels, the diversion of some export containers to Kattupalli port and so on.

(2) Congestion status inside /outside the port

The Team analyzed the congestion status inside and outside the port by dividing the area into 12 sections and identified the bottlenecks of the congestion.

This analysis was conducted to grasp the starting points of congestion which can be understood as the bottlenecks of the traffic flow inside and outside the port.

The starting points of congestion were usually Port Gate No.1 (IN gate), DPW IN gate and Port Gate No.1 (OUT gate) during the Phase I project. During the Phase II project, congestion starting at DPW IN gate was seldom observed. Instead, congestion starting PSA IN gate was sometimes observed while Port Gate No.1 was still observed as the starting point of congestion. This may be because the handling volume at PSA terminal has increased. Newly installed gates dedicated for picking up import containers have become congestion points.

3-5-3. Traffic Survey inside and outside the Port

(1) Stop lines by Traffic Police along roads outside the Port

The Team observed that Traffic Police stop container trailers for a certain period of time at fixed locations along roads outside the Port. It has been sometimes observed that traffic of general vehicles is hindered by double parked trailers along the roads ahead State Highway 114 (SH114) during periods

of heavy congestion.

(2) Improvement of the access road and SH114

The removal of houses that has hindered the widening of SH114 at NTO Kuppam has been completed. The widening of the road and the introduction of a lane dedicated for container trailers (planned in the near future) are expected to alleviate the congestion along this section of SH 114.

The expansion and improvement works of the access road between Port Gate No.1 and SH114 are still suspended. The completion of the conversion work into a four-lane road in this section at early stage is expected as it is very difficult for trailers to pass each other at this area due to the narrow road.

(3) Traffic Flow inside the Port

An exclusive traffic route for empty chassis to receive import container has been established both for DPW and PSA. The traffic flow for empty trailers is completely separated from the one for trailers that bring in containers. This measure is aimed at alleviating the congestion along the route by allowing empty chassis to wait along the separated route.

As for the traffic status inside the Port, the Team often observed traffic congestion at the following points in addition to in front of the main terminal gates.

1) Intersection near the X-Ray inspection area
2) Outgoing trailer flow near Port Gate No.4

(4) Widening/improvement of the internal roads

Expansion works of the road at the sections of the west side of the Boat Basin and Timber Pond are underway. The current 3-lane road will be expanded to 4 lanes in this section. The entire section between the DPW OUT Gate and the area near Port Gate No.7 will be completed when this section is finished.

(5) Realignment of the port premises

The port premises have become narrower due to the widening of the railway section outside between Gate 4 and Gate 6. The boundary fence of the harbor limit has been relocated toward the sea. Realignment work is also being conducted in the port.

(6) Redevelopment of the former Old Navy Barracks (ONB) area

ONB (Old Navy Barracks) and the surrounding areas have been cleared. This is the work to rearrange the land use of ONB and its surroundings. The area will be utilized as a multipurpose cargo handling area.

Furthermore, ChPT has started planting trees around the area as an environmental improvement measure.

(7) Improvement of the DPW IN Gate

The Team prepared the TOR for the operation rule for trailer entry process at the terminal IN gate together with the proposal for changing the layout of the DPW IN Gate based on site surveys during the 8th dispatch. The entrance to gate lanes was clearly segregated by concrete blocks which reduced the number of parked trailers at this area. The Team believes that this change makes working conditions safer for gate surveyors and should also increase the efficiency of gate procedures.

3-5-4. Following-up of Demo 1 to 4

(1) Demo 1: Simplification of gate procedures at Port gate No.1

1) Status of implementing Port entry / exit control system

A Port entry / exit control system similar to the bar code reading system of demonstration trial 1 has not been implemented. The RFID system has been introduced but it is not aimed at controlling trailers' port entry and exit but improving the gate efficiency for the CFS and terminals. The information collected by the RFID system at the Port Gate No.1 is only utilized as statistical data for ChPT senior officers.

On the other hand, ChPT plans to introduce the Port entry / exit control system using RFID technology, which will replace the paper-based Harbor Entry Permit (HEP). However, the public tender process has not yet started.

2) Operational status at Port Gate No.1

The Team found that the trailer entry procedure at Port Gate No.1 had been changed during 11th dispatch. A truck driver has to get off his truck, walk down to the reception desk, then walk back to his truck according to the current procedure, while he could proceed to the reception window in a gate lane without getting off his truck before. Moreover, the reception is conducted in serial order for each trailer while it was conducted in parallel for each lane before.

Furthermore, the number of lanes used for incoming trailers is always 2 now while it was changed depending on the queue outside the Port before.

The Team also observed that the documentation checks are conducted in two rows regardless of the number of lanes deployed (usually 3 or 4) for outgoing trailers at Port Gate No.1. The Team sometimes observed that only one CISF officer was allocated for documentation checks for two rows of trailers although there were many trailers waiting. Traffic congestion starting from Port Gate No.1 was generated inside the Port in such cases.

3) Survey on operation at Port Gate No.1

The Team conducted a survey on the time required for entry/exit procedures at Port Gate No.1 during the 12th dispatch following the changes in the reception procedure at Port Gate No.1 during the 11th dispatch.

The gate entry process was much faster than before according to the table. However, the actual number of trailers going into the Port was less than 50 per hour for each lane on average, even though more than 70 trailers should be able to enter the Port in each lane per hour based on the average processing time. This is because the traffic flow of trailers is not as smooth as before because trailer drivers now are forced to stop and get off their truck in front of the gate for the reception procedure. A similar situation is observed in front of the DPW Main Gate. On the other hand, the gate out process was not any faster than before.

(2) Demo 2: Utilization of TVT-Parking

The utilization of TVT-Parking was not effective for alleviating the congestion during the implementation of the demonstration trial (Demo2) and after that. The TVT-parking was not used as a parking lot although the issuance of HEP was still in operation. Agents or trailer drivers visit here to renew HEP.

(3) Demo 3: Restriction of parking on internal roads

The Team counted the number of parked trailers on the roads. The traffic flow of trailers inside the Port seemed to be smoother due to the separation of traffic flow of empty trailers from laden ones and the decreasing handling volume at the DPW terminal. However, a large number of parked trailers are still observed.

1) On-street parking inside the Port

The following figure shows the areas (A to E) where large numbers of parked trailers were found.

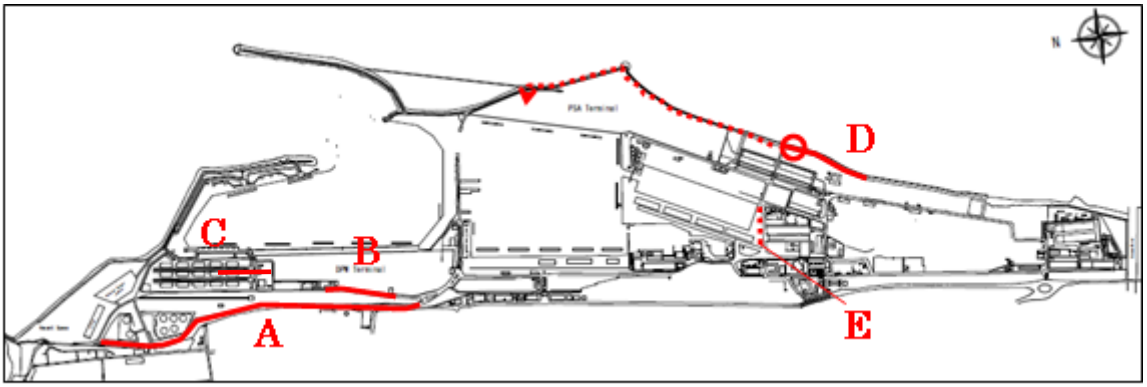


Figure 3-3 Main Areas inside the Port where many Trailers Park

2) Number of parked trailers along the main access road inside the Port

The Team continued to count the number of parked trailers along the main access roads after the demonstration trial and observed that many container trailers still parked there.

3) Number of parked trailers in the waiting space inside the Port

The usage of the waiting space has decreased. The Team considers that trailer drivers try to park along an access road towards a gate in order to proceed to the gate at the soonest possible time.

(4) Demo 4: Allocation of traffic control persons at intersections together with introduction of traffic flow regulation

The Team examined the status of traffic regulations at major intersections inside the Port.

1) Intersection at the X-Ray Inspection Center

Traffic congestion has rarely observed since the DPW North gate was introduced. However, the Team sometimes observed that the trailer flow completely stops due to the mixture of an export trailer flow, an empty trailer flow (only when the normal access route to DPW North gate overflows), and the import trailer flow towards the X-Ray Inspection area.

2) Intersection outside DPW OUT gate

Trailers parked inside the intersection could not be observed. The Team believes trailer drivers have a greater awareness of the no parking rule. Furthermore, traffic control persons were allocated around the intersection near Port Gate No.7 whenever the traffic congestion from PSA IN Gate reached Port Gate No.7.

3-6. Lead Time Analysis

The lead time from CFSs, CWC and factories (designated factory as ACP) to Port Gate No.1 is one of the indicators for evaluating the effect of congestion alleviation measures. On the other hand, shortening the lead time brings benefits to port users, specifically to transport business companies. The Team has conducted the lead time survey 12 times to date.

Though the lead time fluctuates by survey date, lead times of around 40 hours which were recorded at the initial stage of the Phase I project have not occurred in recent days. The lead time has steadily been decreased. (See **section 4-3-2)**

3-7. Traffic Flow Analysis inside the Port

The Team examined the trailer flow inside the Port and identified current issues. The Team also studied the causes of the issues and proposed countermeasures.

(1) North side of Chennai Port

The following issues are identified in this area.

1) Multiple trailer flows are generated towards the X-Ray inspection area including one which crosses another trailer flow at the intersection near the inspection area
2) The trailer flow after X-Ray inspection is not clear
3) A few trailers parked for a long time around the entrance of the inspection area
4) Two empty trailer flows towards DPW merge
5) One of the empty trailer flows towards DPW has to cross another trailer flow at the intersection near the X-Ray inspection area

To overcome the issues described above, the Team proposed the following measures.

1) A new X-Ray Inspection Center is to be established for import containers along the import trailer flow. The existing X-Ray Inspection Center is to be used for export containers only or as a backup facility.
2) Empty trailer flow to DPW is to be unified so that the empty trailers coming from PSA join the flow at Port Gate No.1. The use of any short-cut route has to be strictly prohibited.

(2) Central area of Chennai Port

In the central area of the port, the Team noticed that there are many types of trailer flows mixed on a narrow road. The Team has proposed a priority project on infrastructure, realignment/development of internal roads be implemented to address this issue.

(3) South side of Chennai Port

On the south side of Chennai Port, the trailer flow towards PSA has been greatly improved by the introduction of the new empty gate northeast of the terminal and by the separation of the empty trailer flow from the laden trailer flow by using the access road developed for the coastal terminal. Congestion around PSA has also been eased due to the increase of storage capacity of empty trailers towards PSA along the road.

(4) Proposal on establishing a new Waiting Area for both container terminals

The Team proposed that a new Waiting Area be established for empty trailers near PSA terminal and that the trailer flow be changed accordingly after examining the trailer flow around the south side of Chennai Port during the 10th dispatch.

Furthermore, the Team examined the need to establish new Waiting Areas for both empty and laden trailers near the container terminal gates during the11th and the12th dispatch. The Team considers that such Waiting Areas would alleviate the traffic congestion outside the Port as well as solve several issues regarding the traffic flow inside the Port.

The Team proposed the locations and basic functions of the waiting areas and their operation rules

3-8. Demonstration Trial of Web Portal System

The Team planned a demonstration trial to publish the trailer flow information collected by the RFID system to stakeholders during the 9th dispatch after finding that an inquiry function of such information is provided for the senior officers of ChPT. The Team obtained permission for conducting the demonstration trial during the 11th dispatch. After the ChPT EDP section made the necessary changes to the Homepage, the demonstration trial finally started from July 27th, 2017.

The demonstration trial is now ongoing up to January 2018 and the Homepage is updated every week according to the procedure below.

1) The vendor of the RFID system sends the transaction data of container trailers to the Team once a

week by E-mail.

2) The Team generates the information to be published on the Homepage using the software developed for this purpose and sends it to ChPT EDP section via E-mail.
3) On receiving the E-mail from the Team, an officer of ChPT EDP section updates the Homepage based on the data prepared by the Team.

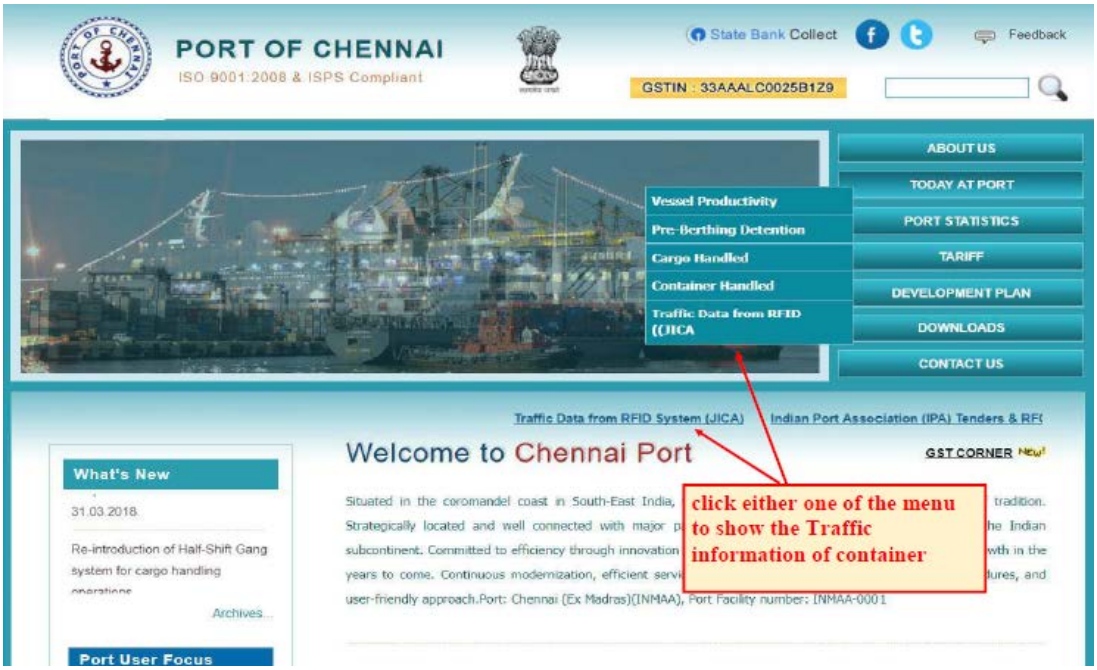


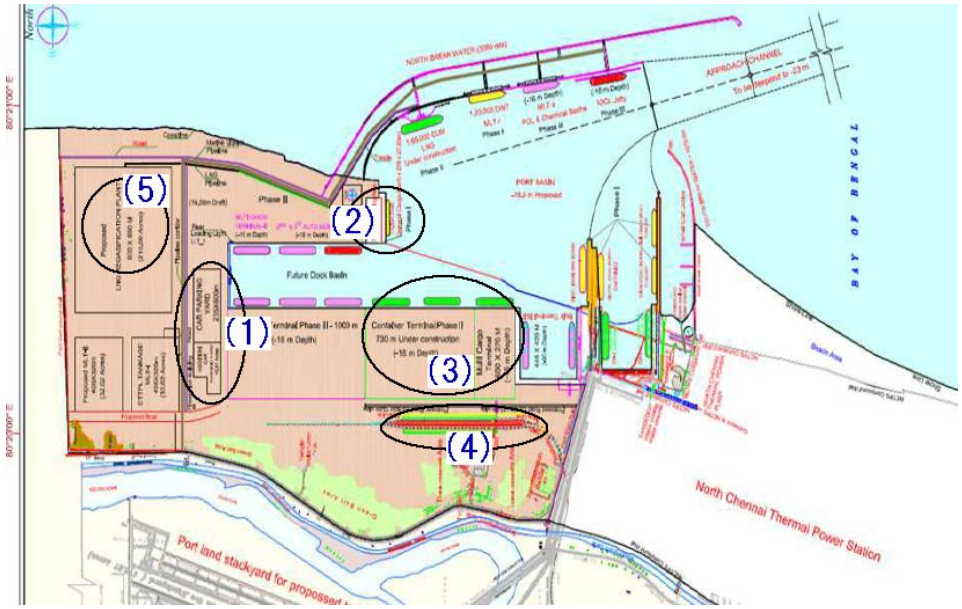
Figure 3-4 Update of ChPT Homepage

3-9. Current status of ports in the vicinity

The ports of Kamarajar and Kattupalli have become strong competitors of Chennai Port for handling containers, complete cars, bulk cargoes etc. These ports have been rapidly developed in recent years. The Team conducted site surveys at these ports to grasp the status of development and current cargo handling levels. Based on the results, the Team will propose ways to modernize and improve operations at Chennai Port.

3-9-1. Kamarajar Port

The current status of development and cargo handling situation at Kamarajar Port are as follows.



Source: Kamarajar Port Home Page

Figure 3-5 Kamarajar Port Master Plan

Kamarajar Port is developing container terminals, multipurpose terminals, liquid natural gas, coal etc. under a PPP scheme.

The container terminal which is being developed by ADANI is the major facility in terms of competition with Chennai Port. The location of the container terminal is indicated as (3) in the above layout. The quay will be 740 meters in length in the first stage; operation commenced in July 2017. A railway line is also being established in the port (indicated as (4) in the layout map) for the transport of containers.

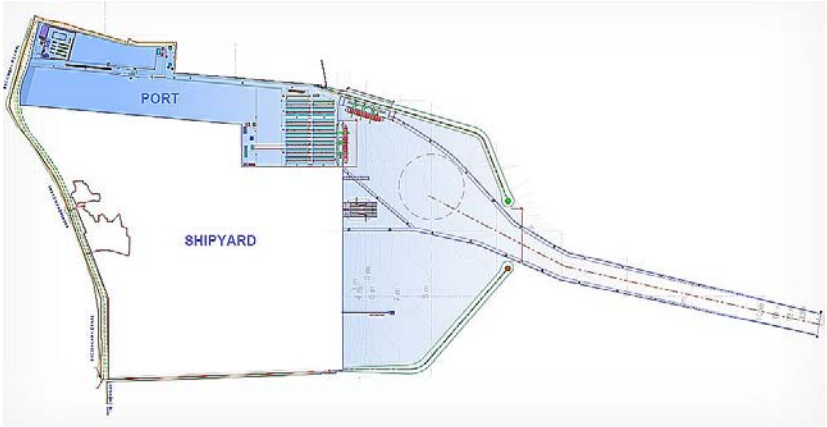
The multi-purpose wharf, which is 200m in length and -11m in depth, is mainly used for exporting new cars. The location of the multi-purpose wharf is indicated as (2) in the map. The carpool which is indicated as (1) in the layout map can accommodate 12,000 cars. When factoring in the storage capacity of 2,000 cars at the quay side, the total storage capacity becomes about 14,000 cars. One more multipurpose berth is planned perpendicular to the current terminal. Development will start once consent is obtained from the Ministry of the Environment. The development of the LNG storage tank is underway and it is scheduled to be completed in 2018. The location is indicated as (5) in the layout map.

The volume of cargo handled in Kamarajar Port is increasing steadily. The port handles coal (about 8.5 to 9 million tons per year) which is transported to the Tamil Nadu State Electricity Authority (TNEB) thermal power plant, small amounts of iron ore and POL, and new cars. The cargo volume exceeded 30 million tons in FY 2014 (April 2014 - March 2015) and in FY 2015.

3-9-2. Kattupalli Port

(1) General Overview

The current status of development and cargo handling situation at Kattupalli Port are as follows.



Source：Kattupalli Port website

Figure 3-6 Kattupalli Port Master Plan

Construction of the Kattupalli International Container Terminal (KICT) began in 2010 and operation commenced in June 2013. It has two quay walls (350x - 14, 360 x - 14), six gantry cranes and 16 RTGs. The handling capacity is reportedly 1.2 million TEUs. Container handling volume rapidly increased from 115,227 TEUs in 2015 (April 2015 to March 2016) to 347,956 TEUs in 2016 (April 2016 to Mar 2017). Since November 2015, Adani Group has been operating the container terminal.

Kattupalli Port is used by Japanese companies such as Komatsu, Sony and Panasonic, etc. In addition to containers, the port handles steel coils, reinforcing bars etc. Adani is eager to attract more Japanese customers to their terminals.

(2) Traffic flow of Trailers

Entrance Gate is located two kilometres west of the container yard (CY) while a Truck Layby (Waiting Area for trailers) and Terminal Gate are found in between.

The waiting Area for trailers has a capacity of 80-90 trailers; document checks and other procedures are conducted here. This reduces the time spent at Terminal Gate. In future, Adani will construct an additional Waiting Area with a capacity of 200-300 more trailers.

On the day of the Team's site survey, more than 20 trailers were parked at the Waiting Area for the procedures, and the traffic flow at the main road was quite smooth. In addition, the traffic flow inside the Waiting Area was also smooth because parking area is apparently separated from the trailer path.

(3) Expansion Capacity

Kattupalli port possesses a lot of vacant areas. Various potential expansion areas are observed adjacent to the current CY. The capacity of the port could be increased by 0.6 Million TEUs once expansion

works are undertaken.

(4) Connecting road to/from Kattupalli Port

According to Adani, the Northern Port Access Road project has already started; priority is being given to the 10km of Phase I and the road to Vallur Junction. Although the state government will construct the road, four private bodies, including Adani, will support this project financially. On the other hand, a part of the Outer Ring Road will be completed by October.

3-10. Interview with Port Users

The Team interviewed the users of Chennai Port in order to obtain their opinions on port facilities and operation. Users interviewed were four (4) Indian associations, one（1）Korean company and eight (8) Japanese companies. Main comments from port users are shown below.

3-10-1. Indian users (and one Korean user)

(1) Is Chennai Port user friendly or not?

- Berth ratio between JD and AD is relatively high. This means either volume might be high or handling efficiency is low. Port System should be modernized.
- Main problem we are facing is infrastructure bottleneck inside the port like insufficient roads to manage the traffic.
- ChPT should increase the unloading capacity of loose cargoes through the use of conveyor belts, etc.
- Chennai Port should maintain and improve efficiency.

(2) Facilities inside the Port

- Timber yard reclamation can be done as there are no bidders. West quay can be used for tug boat repair. Reclamation is possible.
- In general, warehouse is not sufficient. However, AD is presently utilized for car handling which is not good planning.
- Facilities are very limited inside the port due to lack of sufficient space.
- Dr. Ambedkar Dock and Jawahar Dock cannot be utilized fully due to their old structural design and cannot accommodate more bulk cargo. Cars can be accommodated but the storage area is very dirty, etc.

(3) Ship maneuvering

- Regarding the entrance of the JD, if the government allows the handling of dusty cargo, expansion of the entrance by 8 meters should be examined to accommodate future generation ships.
- Currently the JD entrance is about 33 meters. In the meetings with the Team, it was suggested

that JD entrance can be widened up to 48 meters. Based on the current condition, 44 meters may be enough because the width of post Panamax vessels is only 44 meters. The current available draft is 12.5 m to 13 m. In order to widen the JD entrance, the draft should be 15.5 m plus 1m allowance.

(4) Traffic inside the Port

- Smooth traffic flow inside the port is the biggest hurdle in the growth of ChPT as currently proper access to the port is available only for 6 hours a day. Reason for entry restrictions is due to usage of PH Road to approach Gate No.10 which is situated inside the city.
- Traffic flow inside the port needs to be improved. There are extensive delays from Gate No.1 to terminals. Large vessels have diverted their calls to nearby ports. Nearly 30 thousand cargoes have been moved to nearby ports.
- JICA study team's suggestions and proposals have not been implemented properly and thus congestion still exists inside ChPT, etc.

3-10-2. Japanese users

(1) General

- Traffic congestion outside Chennai port has been improved; however traffic inside the port is still congested.
- Port facilities and cargo handling facilities are old and insufficient. Environment of the cargo handling area is not good due to severe dust and the narrow handling area.

(2) Traffic inside the port

- There is heavy traffic of container trailers and tank & bulk trucks inside the port.
- The existing areas of DPW and PSA terminals are often congested.
- Container trailers bound for PSA terminal and bulk cargo trucks from/to Jawahar Dock are often stalled at the crossing points.
- Traffic regulations should be introduced and enforced.

(3) Deteriorated and narrow cargo handling facilities

- The current berths and yards are so old, dirty and dusty that it is not a good environment for storing loading/unloading the parts of the products, commodities and so on.
- The yards behind the berths are insufficient for stocking Ro/Ro cargo.
- Equipment such as forklifts needs to be procured for the improvement of cargo handling at berths.
- It takes a long time to come along the quay due to deteriorated fenders.

3-11. Environmental Management

3-11-1. Environmental Impact Assessment (EIA) in India

Consistent with Japan and JICA's guidelines, the background for Environmental Impact Assessment in India can be traced to Principle 17 of the Rio Declaration on Environment and Development (to which India is a signatory) which states that "Environmental Impact Assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."

(1) Relevant Laws

The Environment Protection Act was enacted in 1986 in response to the need to protect and improve the environment. This Act allows the Central Government to establish authorities to prevent degradation of the environment and deal with specific environmental issues throughout the country. Various rules and notifications have been established under this Act; those most pertinent to ports are as follows:

1. Environmental Impact Assessment Notification
2. Coastal Regulation Zone Notification

It should be noted that minor ports (ports managed at the state level) come under the Coastal Regulation Zone Notification law.

Other key laws are the Water (Prevention and Control of Pollution) Act 1974 and the Air (Prevention and Control of Pollution) Act 1981.

(2) Regulatory Authorities

1. The Ministry of Environment, Forests and Climate Change (MoEFCC) plans and oversees India's environmental policy and programs including EIA.
2. Central Pollution Control Board (CPCB) adopts national environmental standards under various environmental laws, advises the central government on pollution matters, maintains a database on pollution matters and offers technical assistance to State Pollution Control Boards (SPCBs).
3. The SPCBs grant companies permission to establish and operate an industrial plant/factory in air or water pollution control areas. In addition, companies must obtain permission from SPCBs when intending to carry out any activities regulated by environmental laws. The SPCBs also approve or reject renewal applications.

(Note: In India, the preferred term seems to be 'consent' rather than 'permission.')

(3) Environmental Impact Assessment (EIA) Procedure in India

Similar to the case of Japan, projects are categorized into Category A and B. Category A projects require environmental clearance from the Central Government on the recommendations of an Expert Appraisal Committee. Category B projects shall require the clearance from the State/Union Territory

Environmental Impact Assessment Authority, whose decision shall be based on the recommendations of a State or Union Territory Environmental Impact Assessment Authority. In the case of ports and harbors, EIA is a mandatory requirement as per the Ministry of Environment, Forests and Climate Change (MoEFCC) EIA Notification of September 14, 2006 and is also governed under CRZ Notification of February 1991 (most recently amended in 2011). Port and Harbor projects fall under activity No. 7(e). A project is classified as Category A if the cargo handling volume exceeds 5 million tons per year.

3-11-2. Survey of monitoring stations inside the port

There are 12 sampling stations for ambient air quality levels in Chennai Port. A private contractor (Ramky Enviro Engineers Ltd., Hyderabad) has been engaged to monitor and record various environmental parameters, namely, PM10, PM2.5, NO2, SO2, etc. on a monthly basis. The private contractor not only submits the collected data to ChPT but also makes recommendations on ways to improve the air quality.

On May 3rd, 2017, two members of the Team conducted a survey of the monitoring stations in Chennai Port in the company of Dr. K. Kathiravan, Manager of the Environment Cell of the Civil Engineering Department and his two assistants, Mr. M. Gunasekar and Ms. L. Nirmal Veera Rajakumani. As previously mentioned, there are 12 sampling stations throughout the port where separate monitoring instruments for particulate matter and gases have been installed (see the photos below).

In addition, the Team learned that ChPT was erecting display panels to make air quality levels public at 2 or 3 locations near port gates. The Team was confirmed that the display panels were erected during the 11th dispatch and publication of air quality data such as PM2.5, PM10, CO2, NOx and CO had commenced before the 12th dispatch. ChPT is clearly committed to improving the environment of the port.

3-11-3. Baseline data on environmental parameters

In line with world trends, there is a growing recognition among the Indian population of the need to protect and improve the environment. ChPT is committed to enhancing the environment of the port and has introduced a ‘Maritime Pollution Management’ system to protect marine life and improve the ambient air quality. A private contractor (Ramky Enviro Engineers Ltd., Hyderabad) has been engaged by ChPT to monitor and record various environmental parameters on a monthly basis.

The Team examined the data on environmental parameters at Chennai Port for the last 5 years. There has not been any significant change in key environmental parameters during that period.

3-12. Information for Customs Procedures

(1) Computer system for Customs in India

In India, customs clearance is performed using ICES (Indian Customs EDI System). ICES, following the trial of the pilot project at Delhi customs house in 1994-95, gradually came into use at other customs houses from 1997. It is currently operational throughout the country and almost all import / export Customs procedures are performed using ICES.

Only the Customs House Agent (CHA), licensed customs brokers, can access the ICES in principle but the importers / exporters can use the system as well after receiving the approval of Customs. As for the usage of ICES, the CHA or importer / exporter registers or transfers the data of various import / export documents using the client terminal of ICES in the customs service center or using the GUI (Graphical User Interface) based package software for ICES, called 'Remote EDI System', which can be implemented in his own PC.

(2) Ease of doing business

The Government of India is attempting to raise India's 'ease of doing business' ranking (published by the World Bank) in order to promote foreign investment in India based on the Make in India Initiative announced in 2014. Along with this movement, the government has taken several measures such as ratifying WTO (World Trade Organization) / TFA (Trade Facilitation Agreement), etc. while Customs has taken several measures including those described below.

1) DPD (Direct Port Delivery)

DPD is a customs clearance facility where cargoes handled by an authorized AEO (Authorized Economic Operation defined in WTO/TFA) can skip physical checking in principle in Customs clearance procedure. DPD was originally introduced in Jawaharlal Nehru Port and it has been successfully operated. ChPT is now trying to increase the ratio of DPD from 20% to 40%.

2) CCFC (Chennai Customs Clearance Facilitation Committee)

CCFC was organized for each Customs Zone according to the instruction by the Government of India in order to discuss various improvements related to Customs Clearance among stakeholders. In Chennai Customs Zone, CCFC meeting has been held once a month since early 2015. The attendants of the meeting are senior Customs officers, ChPT, Kamarajar Port, Kattupalli Port, Airport authority of India, Drug Control, FSSAI, CONCOR, Plant / Animal Quarantine, Bureau of Immigration, Tamil Nadu Pollution Control Board, NACFS, Chennai / Ennore Steamer Agents Association, CCTL, CITPL, Chennai Customs Broker Association, etc. (Even JETRO has once attended the meeting).

(3) Introduction of GST (Goods and Service Tax)

The Indian government rolled out the new indirect tax regime – GST from July 1 2017. The indirect tax was greatly simplified by the introduction of GST.

The Customs has lately allowed self-sealing for a factory stuffed containers along with the

introduction of GST.[1] The export procedure for factory stuffed containers is slightly simplified by this change because neither the sealing work at the factory nor the re-sealing work at CWC is needed by Customs officers. Furthermore, the Customs also ordered to use an Electric-seal (a seal with RFID function) for self-sealing in the Facility Circular which allows the self-sealing above.

In this way, the introduction of GST may indirectly improve the traffic flow of container trailers inside and outside Chennai Port.

(4) Interviews with stakeholders

The Team conducted interviews with stakeholders. Their main comments are summarized as follows.

1) Overall

- When examining an export container, opening the special packing (vacuum packing, wooden frame packing, etc.) should be avoided as re-packing is costly and difficult.
- A shipper is sometimes forced to go back and forth between Customs offices due to the conflict of views between a Customs officer of the central excise at a factory and an export officer at CFS/CWC.

2) Customs officers

The role of a Customs officer is categorized into multiple authorities (appraiser, examiner, preventive. etc.);

- The Customs process stops if one of the officers is absent
- Users may be forced to visit multiple CFS because officers of all the categories may not stay in a CFS
- Customs officers sometimes have conflicting views

Customs officers often leave their offices

3) Indian Customs EDI System (ICES)

- The system stops once a year for a long time in order to change the tax rate; the whole Customs process stops during this period.
- The system still requires stamps and an officer's signature. It is essentially a manual system.
- The system process has improved; the processing speed is faster than 2 years ago.

4) Comparison with Kattupalli

- A user must visit Chennai Port as well as Kattupalli Port when applying for a vessel call at Kattupalli Port.
- In Kattupalli Port, an import container can be picked up from the container terminal just by the E-DO (Electronic Delivery Order), while the Form 13/DRF (Delivery Request Form), which requires Customs confirmation as well, is required in Chennai Port.

[1] Until then, a Customs officer in charge of central excise sealed a container by a dedicated seal at a factory and an officer in charge of export replaced it with an export seal at CWC near the Port.

Chapter.4 Outcome (Evaluation), Challenges and Recommendations

4-1. Framework of the Technical Assistance Phase II

The Team has implemented the Phase II project following the Phase I project in collaboration with ChPT and organizations concerned. Measures conducted during the Phase II project are shown in the following figure in the framework of the Phase I project.

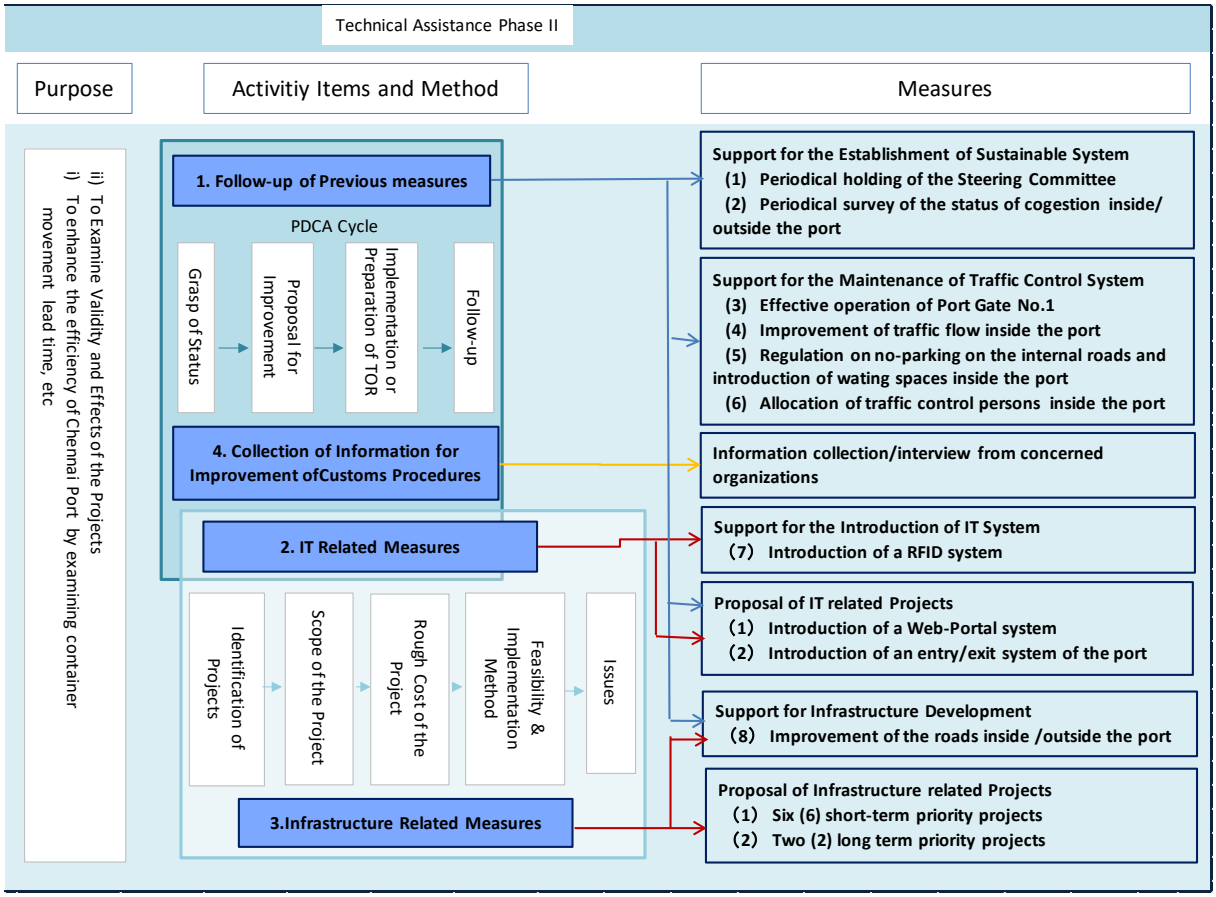


Figure 4-1 Measures conducted during the Phase II project

Among measures conducted in the Phase II project, the operational improvement measures are evaluated and their issues and recommendations are compiled in the following section.

4-2. Evaluation, Issues of the Operational Improvement Measures and Recommendations

4-2-1. Periodical holding of the Steering Committee (S/C)

The Steering Committee (S/C) has been held throughout the project period to discuss and determine basic directions for implementing measures of congestion alleviation. Measures for improving and modernizing the operation of the port have been discussed in S/C as well. S/C consists of ChPT, concerned authorities and stakeholders; it has been a useful vehicle for sharing information and

strengthening cooperation and coordination among concerned authorities and stakeholders.

Therefore, after completion of the technical assistance, S/C will continue to be held periodically to promote the improvement of port operation under the coordination of authorities concerned and stakeholders. The Team has proposed a TOR (Running Rules for the Committee for Implementation of Port Operation and Management) for strengthening the relationship among the authorities concerned and stakeholders.

4-2-2. Periodical survey of the status of congestion inside/outside the port

The Team has conducted the congestion surveys inside/outside the port and other necessary surveys related to congestion through the 12 times of technical assistance periods.

Thanks to the efforts of ChPT, concerned authorities and stakeholders, congestion has been easing; however there are still many issues to be solved. Lack of discipline on the part of drivers and noncompliance with traffic rules are issues which must be addressed to further alleviate congestion. Periodical congestion surveys should also be carried out in order to grasp the status of problems, draw up measures and implement them.

4-2-3. Efficient operation at Port Gate No.1

The Team has made necessary proposals for efficient operation at Port Gate No.1 through the observation of the operational status around Port Gate No.1 conducted as the follow-up to demonstration trial 1. Notably, the Team pointed out to ChPT that the reception procedure at Port Gate No.1 had been changed and it was one of the major reasons for the recent increase in traffic congestion outside the Port during the 11th dispatch.

ChPT has to put in place a system which makes it possible to grasp any changes in operational procedure as it will be necessary to ChPT to solve the issues by themselves in future.

4-2-4. Improvement of traffic flow inside the Port

The Team examined the traffic flow inside the Port and identified the following issues and countermeasures during the 10th dispatch.

Table 4-1 Major Issues and Countermeasures in Traffic Flow inside the Port

Area	Issues	Countermeasures
North side	Import trailers for X-Ray inspection have to cross another trailer flow at the intersection near the inspection area	To implement a new X-Ray inspection area dedicated for import containers along the traffic flow of import trailers
	Two empty trailer flows towards DPW merge	To unify empty trailer flow so that empty trailers coming from PSA join the flow at Port Gate No.1

Central	Too many types of trailer flow are mixed on a narrow road	To implement realignment/development internal roads proposed by the Team
South side	The access road for coastal cargoes is occupied by empty trailers towards PSA East Gate	To establish a new waiting area for empty trailers and change the empty trailer flow accordingly

4-2-5. On-street parking ban inside the Port and establishment of a new Waiting Area

The Team conducted the demonstration trial aiming at the introduction of an on-street parking ban inside the Port during the technical assistance (Part I). The Team pointed out that on-street trailer parking inside the Port was regularly observed during the technical assistance (Part II) and that this was one of the factors inhibiting an optimum trailer flow. However, on-street trailer parking along the traffic flow has not been decreasing.

The Team proposed that new Waiting Areas be established for both empty and laden trailers near the terminal gates of both container terminals including their arrangement and operational procedure during the 11th dispatch. Establishing these Waiting Areas will contribute to alleviating the traffic congestion outside the Port, coupled with further improvement of the efficiency at Port Gate No.1[2]. Moreover, it is recommended to strictly enforce the parking ban along the access roads as well as the waiting area in accordance with the established operation rules.

4-2-6. Allocation of traffic control persons

The allocation of traffic control persons conducted as the demonstration trial during the technical assistance (Part I) has continued. Places where traffic control persons are allocated have been gradually increased and they are giving instructions to drivers more vigorously than in the past. However, places where traffic control persons are allocated must be continuously examined and re-evaluated. For example, traffic control persons may have to be allocated near Port Gate No.4 and along the outgoing trailer flow towards Port Gate No.1 as incidents of on-street parking have been observed there.

4-2-7. Introduction of RFID system

ChPT, NACFS, both container terminals, and Customs office inside the Port have introduced the RFID system in order to simplify the entrance and exit procedure at several gates. However, neither the container terminals nor ChPT currently utilize the information obtained from the RFID tag at all. Both container terminals have to link the Terminal Operating System (TOS) with the RFID system in order to improve the efficiency of terminal gate operation. ChPT has to examine the usage of the data collected by the RFID system based on the demonstration trial of the Web Portal System which is currently being conducted.

[2] A Waiting Area inside the Port will not be effective unless Port Gate No.1 releases more trailers than the capacity of handling trailers at terminal gates.

ChPT is considering the introduction of the RFID system for Port entry/exit control. The Team has supported the introduction of the system and has recommended that RFID tags be shared with the RFID system, which is currently operated by NACFS, etc. ChPT has to introduce the RFID system for entry/exit control as soon as possible in order to improve the efficiency of the reception procedure and to enhance the functionality of Port entry/exit control.

4-2-8. Improvement of road infrastructure outside the Port

The Ennore Manali Road Improvement Project (EMRIP) has been carried outside the Port for more than 10 years mainly by the Tamil Nadu state government. The aim of the project is to improve roads from Port Gate No.1 to Kamarajar Port. Approximately 95% of the project has now been completed with work pending on only on two parts: one at NTO Kuppam along the SH114 and the other near Port Gate No.1 along the access road from SH114 to Port Gate No.1. Both the dedicated lane for trailers around the narrow part of the state road 114 and 4 lane access road behind the fishing harbor have to be completed as soon as possible.

The road improvements and enhancement have been continuously conducted inside the Port as well as the clear lane separation. Such works have contributed to the improvement of the traffic flow inside the Port to some extent. Therefore, continuous efforts for improvement of infrastructure are expected.

4-3. Objective Evaluation for the Technical Assistance and Recommendations

4-3-1. Evaluation of measures for congestion alleviation outside the port and challenges

The Team has surveyed the congestion status outside the port from the beginning of the project. The figure below shows the results of the regular traffic check by the Team which includes the maximum and average number of queuing trailers, corresponding monthly container handling volume, and export container handling volume in time sequence.

	Data Collection Survey	1st Dispatch	2nd Dispatch	3rd Dispatch	4th Dispatch	5th Dispatch	6th Dispatch	7th Dispatch	8th Dispatch	9th Dispatch	10th Dispatch	11th Dispatch	12th Dispatch
Maximum/day	1,097	1,024	1,478	568	709	754	849	874	497	716	526	711	487
Average/day	819	373	467	162	336	274	441	505	253	257	146	474	145
Handled Container (TEU) /Month	121,315	134,506	129,281	113,078	137,301	142,087	134,526	129,091	119,138	105,977	130,545	132,390	128,631
Reference: Export volume (Laden Container)	53,181	54,756	51,047	49,047	51,416	50,554	47,938	44,950	33,366	37,602	36,181	35,377	34,590
Export share	43.8%	40.7%	39.5%	43.4%	37.4%	35.6%	35.6%	34.8%	28.0%	35.5%	27.7%	26.7%	26.9%

Figure 4-2 Trend of Congestion Status outside the Port

The status of congestion outside the port has changed with each dispatch as can be seen above; however as an overall trend, congestion has steadily been decreasing and queues exceeding 1,000 trailers has no longer observed. Port users including Japanese companies have also said that the congestion status of Chennai port has significantly improved.

However, there is still congestion outside the port; therefore sustainable efforts to tackle congestion in collaboration with all stakeholders are required.

4-3-2. Evaluation of the lead time results and its challenges

Evaluation and challenges of the measures conducted from the viewpoint of the lead time survey are as follows.

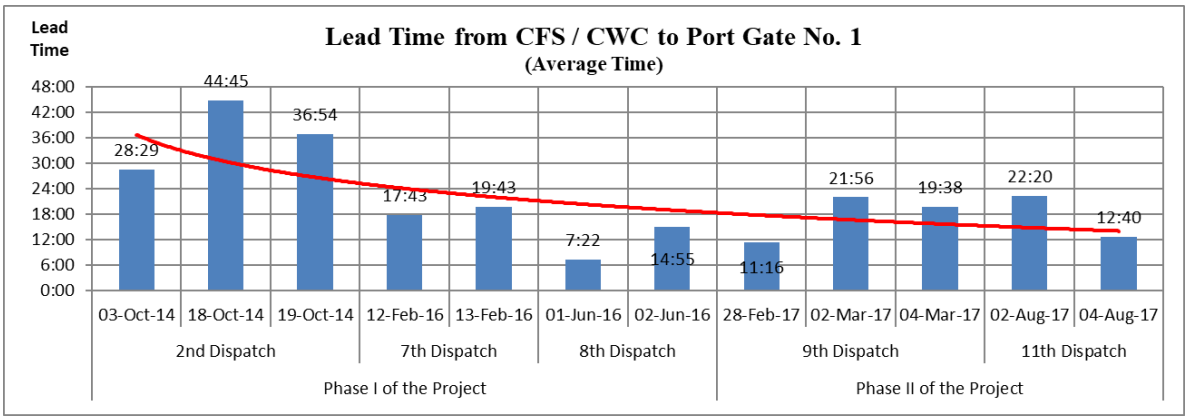


Figure 4-3 Survey Results of the Lead Time

Though the lead time fluctuates by survey date, lead times of around 40 hours which were recorded at the initial stage of the Phase I project have not been observed in recent days. The lead time has steadily decreased. Shortening of the lead time can be confirmed from the analysis of RFID data shown in the next section.

As explained above, the lead time has been steadily decreasing. It seems that a variety of measures conducted in collaboration with organizations concerned brought positive results. Such measures should be continuously conducted in cooperation with ChPT and stakeholders and a sustainable system should be established to tackle congestion and improve port operations.

4-3-3. Reduction of the Reception Time at Port Gate No.1

The following figure shows the transition of time required for entry/exit procedures at Port Gate No.1. It was reduced by implementing the demonstration trial 1 (Introduction of Bar Code Reading system for simplification of the Gate Procedure). Although the trial was completed in August 2015, the reception time has been reduced after that thanks to the efforts by stakeholders such as CISF, etc. As the reception time at Port Gate No.1 greatly affects the congestion outside the Port, the stakeholders have to grasp the changes in processing time there and take necessary actions to reduce it whenever necessary.

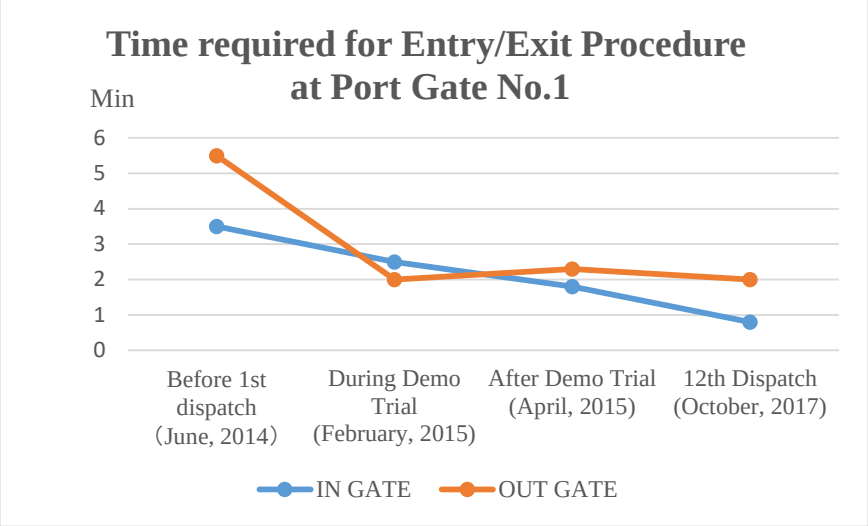


Figure 4-4 Transition of time required for Entry/Exit Procedure at Port Gate No.1

4-3-4. Evaluation of Introduction of Web Portal System and its challenges

The Team conducted the demonstration trial of the Web Portal System using the data collected by the RFID system during the 11th dispatch in addition to the trial conducted during the technical assistance (Part 1). The ChPT Homepage publishes the daily lead time and hourly summary of traffic flow for each site based on the data collected by the RFID system.

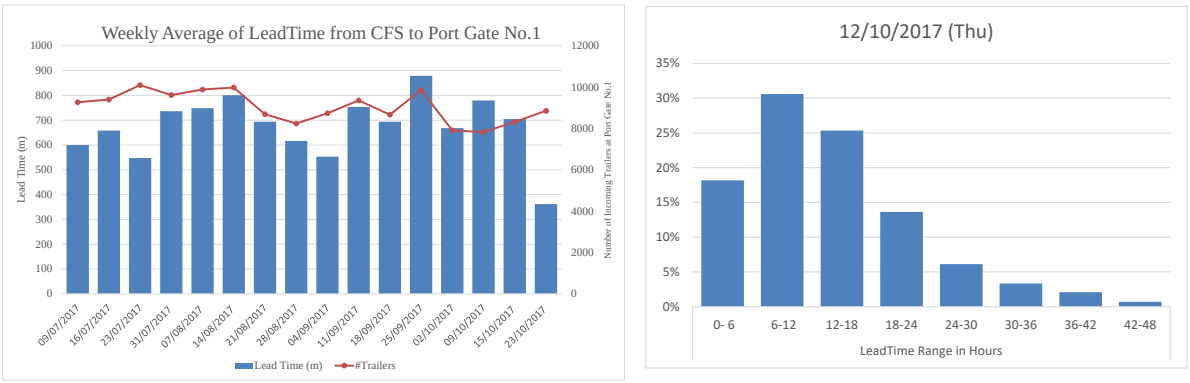


Figure 4-5 Weekly Variation of the Lead Time and Number of incoming Trailers / Histogram of Lead Time on a Particular Day

The demonstration trial of the Web Portal System was conducted aiming at spreading the importance of sharing information on traffic congestion among stakeholders. As a result, it was effective not only for achieving the above aim but also for selecting the information to be shared. Furthermore, it was confirmed through the trial that there is no technical issue for introducing the full-fledged Web Portal System.

It is recommended that ChPT establish a sustainable system and utilize the traffic congestion information continuously, which is shared among stakeholders, in order to alleviate the traffic congestion.

4-4. Recommendations toward the Next Step

4-4-1. Continuous observation and survey on congestion status

Congestion is a complicated phenomenon. In order to propose and implement effective measures to reduce congestion, continuous observation and survey on congestion are essential to understand the underlying causes of congestion.

The Team has conducted a variety of observations and surveys inside/outside the port to grasp the congestion phenomenon. By conducting the above observations and surveys, the Team was able to understand some of the causes of congestion which aided us in proposing measures to alleviate congestion.

Therefore, ChPT should conduct necessary observation and survey on congestion in collaboration with concerned organizations and stakeholders in order to grasp the congestion status and identify appropriate measures for congestion alleviation. As the RFID system has recently begun operation, utilization of data obtained by the system and introduction of a monitoring system with live cameras proposed by the Team may be effective.

4-4-2. Coordinated measures for congestion alleviation

As the traffic congestion is caused by a variety of factors which are interrelated, countermeasures should be examined from several viewpoints and implemented concurrently.

The Team studied the relation between the trailer processing capacity among major points in the trailer flow and the traffic congestion during the technical assistance (Phase I). The results are shown below.

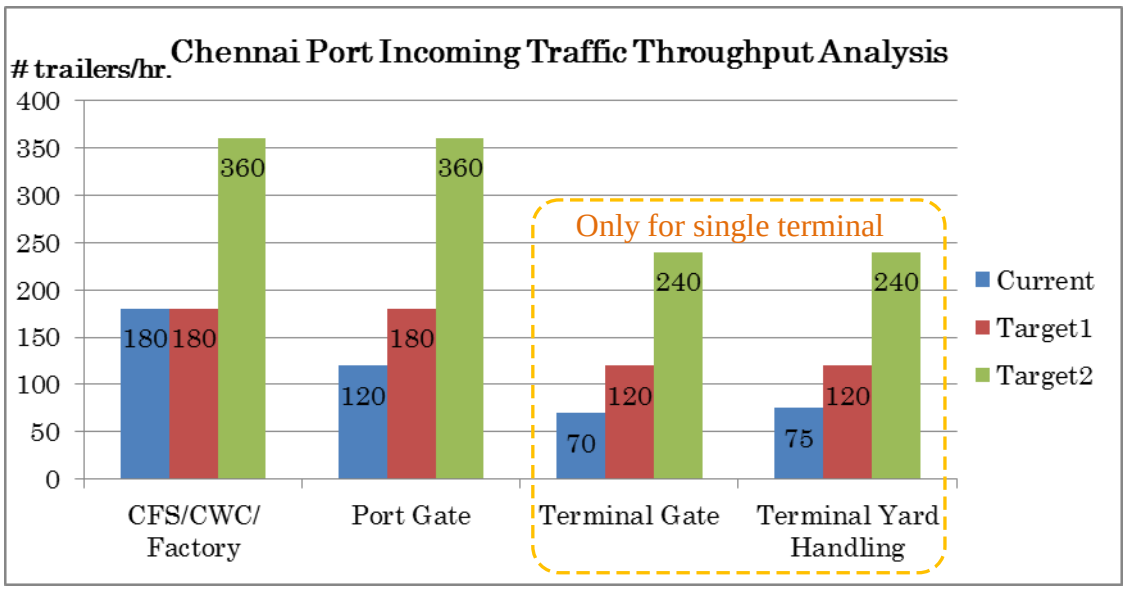


Figure 4-6 Comparison of Processing Capacity among major Points in the Trailer Flow

There is a close relation among the trailer processing capacity at Port Gate No.1, the trailer processing

capacity at both terminal gates, and the container handling capacity of the container yard for both terminals. Adopting a simplified model where the capacity of traffic flow only depends on the trailer or container handling capacity at major points in the trailers flow, trailer queue is generated outside the Port if Port Gate No.1 cannot process a sufficient number of trailers, which originate from the CFS, CWC, factories, and inland depot, in a certain unit of time. In the same way, traffic congestion occurs inside the Port if the terminal gates cannot process the number of trailers which go through Port Gate No.1 in a certain unit of time. On the other hand, if heavy traffic congestion occurs inside the Port, the trailer entry process must be stopped at Port Gate No.1; congestion will disappear if the terminal gates accept more trailers than those which go through Port Gate No.1. This is the same in relation between number of trailers processed at the terminal gates and number of containers handled in the yard of the terminals.

In this way, ChPT has to implement countermeasures continuously to solve traffic congestion issues based on regular observation and by examining the relations among each issue.

4-4-3. Establishment of sustainable system

The congestion phenomenon occurring inside/outside Chennai port is a very complicated phenomenon in which various factors are intertwined. There is no single measure which can magically resolve congestion issues in a short period of time. Congestion is a phenomenon which involves many organizations and stakeholders. Therefore, such organizations and stakeholders need to coordinate and cooperate with each other and make sustained efforts to resolve congestion issues.

Utilization of the PDCA (Plan-Do-Check-Act) cycle which entails “observing and grasping the phenomenon (in this case ‘congestion’), preparing and implementing measures, analyzing and evaluating, and finally improving the measures” in order to tackle congestion issues is an effective method for promoting sustainable efforts. In addition, information sharing among organizations and stakeholders are vital as well.

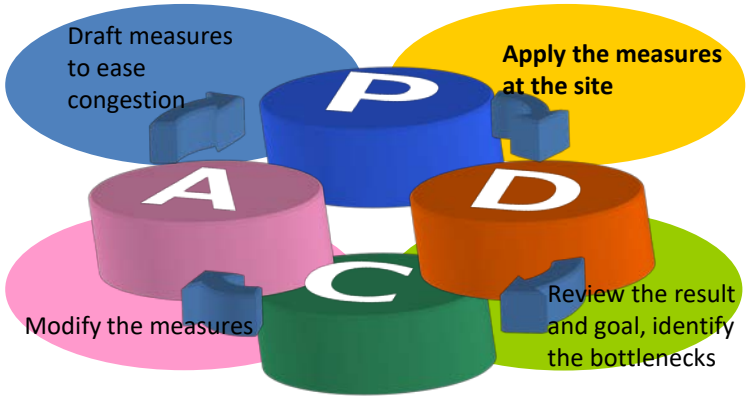


Figure 4-7 PDCA Cycle Method

To do the above, establishment of an effective framework/mechanism will be needed. Organizations and stakeholders could work together and tackle the issues continuously only by establishing such a

framework/mechanism.

To support the establishment of such a framework/mechanism, preparation of TOR (Terms of Reference) is required. TOR here means some kind of so-called “guiding principle” which indicates the method to establish and operate the framework/mechanism.

Following TORs have been prepared by the Team. Details are attached in Appendix.

1. (Draft) Running Rules for the Committee for Improvement of Port Operation and Management
2. (Draft) Running Rules for the Working Group for Sustainable Operation of Entry/Exit Control
3. (Draft) Operation Rules in the Waiting Are for Trailers
4. (Draft) Operation Rules for Trailer Entry Process at Terminal In Gate
5. (Draft) General Rules for Port Users on Use of Port

Chapter.5 Modernization of Port Operation

5-1. Modernization of Port Operation (IT related Measures)

5-1-1. Operational status of the RFID system

(1) Operational status of the RFID system

1) RFID tags on trailers

RFID tags have been installed on more than 9,000 trailers, which is about 90% of trailers in the Chennai area.

2) Installation of RFID readers

RFID readers have been installed at all lanes of gates in the CFS, Port Gate No.1, and the main gate of container terminals. However, they are not installed in DPW North Gate or PSA East Gate.

3) Operational status at the CFS

RFID system is operational in most of the CFS. In case of full export containers, the information of a trailer (RFID tag) is linked with the data of export container and CFS Gate Pass.

4) Operational status at ChPT

The inquiry function, which shows all the transactions of trailers passing through the gates at CFS/Port Gate No.1/Container terminal on a PC screen, is provided by NACFS or the vendor of the RFID system.

5) Operational status at container terminals

Currently, the terminal operating system (TOS) of both terminals is not integrated with the RFID system in gate receiving/delivery operation although RFID readers have been installed at terminal gates.

6) Operational status at Customs

The vendor of the RFID system has also introduced the system for Chennai Customs in order to simplify customs procedures. According to the vendor, the system has been implemented with PCs in the Customs office both at container terminals and Port Gate No.1 and it is in operation.

(2) Issues related to the RFID system

1) The RFID system is not available for some of the trailers because a container trailer without an RFID tag is able to enter the Port.
2) Currently, the RFID system does not contribute to the improvement of the efficiency of the terminal gates because the TOS in both terminals do not coordinate with the RFID system.
3) The RFID system will not have any effect on gate efficiency because the data entry for linking the trailer ID with the work order may not be completed before the trailer arrives at the gate.

4) There is no official document like Form 13 in the case of exporting empty containers.
5) The information captured by RFID readers at Port Gate No.1 has not been utilized effectively.

(3) Introduction of RFID systems at Ports in the vicinity

Kamarajar Port and Kattupalli Port have already introduced the RFID system developed by the same vender as Chennai Port. These systems use the same RFID tags as in Chennai Port as trailers may visit all three ports.

(4) Others

ChPT intends to replace the current Port entry/exit control system using paper based HEP with an RFID based HEP system.

5-1-2. IT Related Projects

The Team proposed the following two projects.

Priority Projects

Pressing Issues Facing Chennai Port	Modernization of Port Operation utilizing IT Technology i) Visualization of congestion status, ii) Sharing KPI for traffic congestion among stakeholders, iii) Improvement of port entry / exit procedures, iv) Improvement of Port security, v) Improvement of port entry / exit management functions	
Phase of the Project	**Based on degree of urgency, the priority projects are classified into two phases; I) Short-Term Projects to be implemented in the short term, II) Long-Term Projects to be implemented in the long term**	
	I) Short-Term Project	
Project Name	**IT - A**	**IT - B**
	Introduction of Web Portal System	Introduction of RFID based Harbor Entry Pass System
Target	i) Visualization of congestion status of container trailers inside and outside the port ii) Sharing Key Performance Indicator (KPI) for traffic congestion among stakeholders	iii) Improvement of port entry / exit procedures by issuing RFID based Harbor Entry Permit (HEP) iv) Improvement of port security v) Improvement of port entry / exit management functions
Purpose	To foster cooperation among stakeholders by sharing the common indicator which shows the degree of congestion and its improvement	To expedite port entry / exit procedure as well as improve port Security
Scope	1) Computer Server (Web/Database/Application, etc.) - To apply redundant fault tolerant hardware configuration - To include the necessary system software such as OS, DB, WEB, etc. - The implementation cost may be reduced by more than 50 % if these functions are implemented in the existing ChPT Homepage. 2) Cameras and data communication equipment, etc. - To link the existing CCTV system and obtain live pictures inside the Port - To implement Web cameras at key congestion points outside the Port. 3) Application Software - Connection with external systems - Publishing live pictures at congestion points - Publication of trailer movement statistics in real time, etc. - Publishing the statistics of traffic congestion inside and outside the Port. - Statistical functions currently provided in ChPT Homepage can be enhanced in the Web Portal System.	1) Card issuing machine - A machine which issues HEP cards, etc. 2) Kiosk for entry /exit at Port gate - RFID reader for Port entry card, RFID reader for truck, etc. 3) Port entry card for persons x 10,000 - Passive RFID tag, photo of holder, etc. - FeliCa type RFID technology, which is commonly used in Japane and very reliable, is recommended. 4) RFID tags for trailers x 8,000 - To be attached on a front panel of a trailer - It must be examined whether RFID tag of container trailer used in NACFS RFID system can be also utilized for this application. 5) Computer servers - Cloud environment may be applied 6) Application software - To issue HEP and associate with RFID tag, etc. - To extend validity period of HEP - Reception function at Port Gate No.1 - 10 - To output statistical reports - Connection with external systems 7) Operational support - On site support for a few months after commencement of operation, etc.
Construction Period/Cost	Period: Approximately 12 months Cost: Approximately USD 1 M	Period : Approximately 12 months Cost: Approximately USD 3M
Prescreening	-	-
Project Effects	1) Effects of measures on traffic congestion can be evaluated objectively among stakeholders 2) Cooperation among stakeholders is obtained 3) Image of Chennai Port is improved	1) To strengthen Port entry / exit control 2) To utilize RFID based HEP for other purposes
Issues for Implementation	1) Method of publishing live pictures of traffic congestion 2) Examination of the information to be published on Web Portal System 3) Automation of the procedure to publish information	1) Examination and evaluation of the operational procedure

ExchangeRate; 110yen/USD
Exchange Rate: 62.5Rp/USD

5-1-3. Challenges in IT Utilization

(1) Examination of the leading examples

It is recommended to refer to the existing systems which utilize advanced IT inside and outside India before introducing the IT system. It is necessary to examine not only the applied technology but also the development process and its schedule, operational procedure, development organization, etc. through the observation of the actual operation and interviews with operators.

(2) Establishing the sustainable system for operation

The demonstration trial of the barcode reading system conducted by the Team made it clear that establishing a sustainable system is essential in order to operate a system continuously. In reality however, most of the system maintenance work is left to the system vendor; it seems difficult to operate the system continuously over a long period of time. ChPT itself must develop a sustainable system which supports the operation of the system continuously.

5-2. Modernization of Port Operation (Infrastructure related Measures)

5-2-1. Trend of cargo volume handled at Chennai port and its Hinterland

(1) Trend of cargo volume handled

Trend of cargo volume handled by Chennai Port is shown in the following table. Container cargo volume has been steadily increasing. (See **Table 3-1**)

(2) Drawing of the hinterland

Regarding container cargoes, Bangalore in Karnataka, approximately 300 km away, and Hyderabad in Telangana, approximately 700 km away, are regarded as important hinterland areas. Imported limestone and dolomite are transported to steel mills in Tamil Nadu and Karnataka. In addition, cement clinker produced at the cement plants in Andhra Pradesh is exported through Chennai port. In recent years, imported wheat is distributed to Bangalore, Hyderabad as well as Assam, approximately 3,000 km away. The hinterland of Chennai port is very wide.

(3) Mode-wise Hinterland Analysis

6-7% of all containers handled at Chennai port are transported by rail to/from Bangalore ICD, and 12% are transported by CONCOR trucks to/from Bangalore (and Hyderabad) ICD. The remaining 80% pass customs clearance at Chennai and are transported by trucks.

5-2-2. Traffic Projections of Chennai Port

Coal and Iron Ore are not able to be handled at Chennai port because of the environmental problem

and the government's embargo on iron ore. Container volume has been broadly flat in recent years. There is an idea that Chennai port should target 4-C cargoes (container, complete car, cruise ship and clean cargo), although in interviews conducted by the Team many commented that Chennai port should target container, Ro-Ro cargo, general cargo, steel products and so on.

5-2-3. Basic Policy for Priority Projects

The port of Chennai which is located on the south-east coast of India is one of the 12 major ports in India and plays a vital role in supporting the economy of both the region and India as a whole. This role will remain unchanged in future.

However, Chennai port faces a variety of pressing issues such as superannuated facilities, abnormal traffic flows inside the port, limited expansion space due to the close proximity of the urban area as well as environmental degradation. Furthermore, competitors such as Kamarajar port, Kattupalli port and Krishnapatnam port have been expanding their businesses in recent years.

Against this background, it is necessary to improve the efficiency of port operations, modernize facilities and enhance the port's competitiveness.

In particular, ChPT has to overcome the following issues; i) Normalization of traffic flows inside the port, ii) Improvement of superannuated facilities, iii) Securing sufficient space for cargo handling and storage, iv) Improving efficiency of cargo handling, v) Improvement of the environment, vi) Accommodating larger vessels, vii) Improvement of navigational safety, and viii) Securing future development space for the next generation of Chennai port. Issues i) to v) are long-standing issues that Chennai port has been facing, issues vi) and vii) have emerged due to international maritime trends while issue viii) needs to be addressed to realize the next generation of Chennai port.

In order to overcome the issues abovementioned, the Team proposes the following priority projects A to H. Among these priority projects, A to F can be categorized as short-term projects while G and H can be categorized as long-term projects.

The priority projects proposed in the following pages are mainly redevelopment projects which will improve and realign the existing facilities. Redevelopment projects require that alternative facilities be available for maintaining functions during construction. Therefore coordination among the existing facilities and planned facilities is a must in terms of construction timings and schedules.

5-2-4. Priority Projects

Figure 5-1 Priority Projects

Details of the priority projects are explained as follows

Exchange rates are as follows; 1 USD = 110 yen, 1 USD = 62.5 Rs

Short-term Projects

Peiority Projects

Pressing Issues Facing Chennai Port (exclusive of connectivity)	i) Normalization of traffic flow inside the Port, ii) Improvement of superannuated facilities, iii) Securing sufficient space for cargo handling and storage, iv) Improving efficiency of cargo handling, v) Improvement of the Environment, vi) Accommodating larger vessels, vii) Improvement of navigational safety, viii) Securing the future development space		
Phase of the Project	Based on degree of urgency, the priority projects are classified into two phases; I) **Short-Term Projects** to be implemented in the short term, II) **Long-Term Projects** to be implemented in the long term		
	I) Short-Term Project		
Project Name	**A**	**B**	**C**
	Realignment/Development of Internal Roads	Redevelopment of Dr. Ambedkar Dock (West Wharf)	Widening of Jawahar Dock Entrance
Target	i)Normalization of traffic flow inside the Port	ii) Improvement of super annuated facilities, iii) Securing sufficient space for cargo and storage, v) Improvement of the environment, vi)Accommodating larger vessels, vii) Securing navigational safety	ii) Improvement of superannuated facilities, v) Accommodating larger vessels
Purpose	/To improve the traffic flow and ease congestion inside the Port	/To modernize the West Wharf of Dr. Ambedkar Dock and the water area	/To improve superannuated facilities and to accommodate larger vessels
Scope	/To develop new internal roads for separation of DPW and PSA related traffic and to introduce a flyover section of ; Option A-1: 500m in length Option A-2: 2,000m in length Option H-1: Internal roads are inter-connected with the Maduravoyal elevated road. Descendent points of the said road are explained.	/To expand the west wharf by 600m in length and 100m in width /To rearrange the cargo handling area, and /To deepen the water area of the Dock to 15m to 16m	/To widen the entrance of Jawahar Dock /to more than 43m (effective width) in order to accommodate vessels of over-panamax class
Rationale	(refer to the Interim Report)	(refer to the Interim Report)	(refer to the Interim Report)
Construction Period/Cost	Option A-1: Period: Approximately 36 months Cost: Approximately USD 42 M Option A-2: Period: Approximately OO months Cost: Approximately USD 129 M	Period : Approximately 23 months Cost: Approximately USD 137 M	Period : Approximately 26 months Cost: Approximately USD 36 M
Prescreening	(refer to the Interim Report)	(refer to the Interim Report)	(refer to the Interim Report)
Project Effects – **Quantitative Effect**	/Reduction of time cost by elimination of congestion: maximum value of 42.4 Crore Rp/year	/Income from the use of the West Wharf: 65.0Crore Rp/year /Avoiding an additional distribution cost to an alternative port: about 2.9 Crore Rp/year	/Loss of income by collapse of the entrance: 13.83Crore Rp/year
Project Effects – **Quantitative Effect**	/More reliable transport /Shortening of transport time (benefit of trucking company) /Improvement of the environment /Development of the hinterland economy	/Improvement of cargo handling efficiency /productivity /Decrease of damaged cargo /Expansion of business opportunities /Improvement of navigational safety /Improvement of the environment /Development of the hinterland economy	/Improvement of safety /Development of the hinterland economy
Issues for Implementation	/Cogestion alleviation at specific points is important. /Further study is needed because of the progree of improvement of the internal roads /Careful execution plan is needed in oder to avoid further congestion	/Detailed use plan of berthe is needed /Execution plan to avoid shortage of berths is needed /User's opinion is important /The navigation area needs to be examined /Consideratoin of redevelopment of the Old North Quay is needed /Introduction of warehouses and equipment should be considered in connection with fund raising	/Safe and realistic execution plan should be studied further to avoid negative effects to the tanks located behind the entrance /Securing navigational safety during execution works is important / Execution works should be done from the land side / The width of the entrance and acceptance of over-panamax vessels should be examined carefully /To make fund raising easier, this project should be combined with others

ExchangeRate; 110yen/USD
Exchange Rate: 62.5Rp/USD

Priority Projects

Pressing Issues Facing Chennai Port (exclusive of connectivity)		i) Normalization of traffic flow inside the Port, ii) Improvement of superannuated facilities, iii) Securing sufficient space for cargo handling and storage, iv) Improving efficiency of cargo handling, v) Improvement of the Environment, vi) Accommodating larger vessels, vii) Improvement of navigational safety, viii) Securing the future development space		
Phase of the Project		Based on degree of urgency, the priority projects are classified into two phases; I) **Short-Term Projects** to be implemented in the short term, II) **Long-Term Projects** to be implemented in the long term		
		I) Short-Term Project		
		D	**E**	**F**
Project Name		Reclamation/Redevelopment of Timber Pond (including a base for tug boats)	Integrated Redevelopment of Jawahar Dock and Surrounding Area	Improvement of the Environment inside the Port
Target		iii) Securing sufficient space for cargo and storage, iv) Improving efficiency of cargo handling, v) Improvement of the Environment, i) Normalization of traffic flow inside the Port	ii) Improvemet of superannuated facilities, iii)Securing sufficient space for cargo handling, iv) Improving efficiency of cargo handling, v) Improvement of the Environment, vi) Accommodating larger vessels, i) Normalization of traffic flow inside the Port	vi) Improvement of the Environment
Purpose		/To secure space for cargo and storage, improve the efficiency of cargo handling and to help the traffic flow be normalized	/To redevelop the JD entrance and handling yard of surrounding area and to contribute to the alleviation of congestion	/To improve the environment of the port; specifically to reduce dust generated from cargo handling
Scope		/To reclaim Timber Pond and demolish buildings in the surrounding premises for use of cargo handling and storage and new road development /To develop a base for tug boats	/To widen the JD entrance to more than 43m /To rearrang the yard area behind the JD west wharf integrally with the yard of ONB and the Timber Pond area /To convert the JD west wharf in to a wharf for accommodating RO-RO vessels /To ease traffic congestion casued by car carriers behind tDr. Ambedkar Dock	/To further develop green areas, and /To install functions to reduce dust
Rationale		(refer to the Imterim Report)	(refore to the Interim Report)	(refer to the Interim Report)
Construction Period/Cost		Period : Approximately 20 months Cost: Approximately USD 29 M	Period: Approximately 26 months Cost: Approximately USD 54.5 M	Cost: Approximately USD 25.5 M
Prescreening		(refer to the Imterim Report)	(refer to the Interim Report)	—
Project Effects	**Quantitative Effect**	/Savings of expenditure for improvement of handling efficiency: 7.23Crore Rp/year	/Loss of income by collapse of the entrance: 13.8Crore Rp/year /Normalization of traffic flow between car carriers and trailers: 3.4Crore Rp/year	—
	Qualitative Effect	/Improvement of cargo handling efficiency / productivity /Normalization of the traffic flow /Improvement of the environment /Development of the hinterland economy	/Improvement of safety /Improvement of cargo handling efficiency / productivity /Improvement of the environment /Development of the hinterland economy	Improvement of the environment (such as protecting the health of port workers and users, preventing fatigue, and enhancing safety) /Improvement of productivity (in case of introduction of silo,etc.) /Improvement of the quality of transport service
Issues for Implementation		/Use request from ICG should be considered /Integrated use with AD and JD shouled be considered /Reconstruction of buildings necessary for future use is requires /Measures to mitigate impact on the environment are needed during demolishing works	In addition to the isues of Project C & D, /Discontinuation of the use of the road between the JD yard and ONB /Further examination of introduction of multilayer car pool and integrated use with ONB yard /Demand for covered sheds and redevelopment should be considered	—

ExchangeRate; 110yen/USD
Exchange Rate: 62.5Rp/USD

Long-term Projects

Priority Project

Pressing Issues Facing Chennai Port (exclusive of connectivity)		i) Normalization of traffic flow inside the Port, ii) Improvement of superannuated facilities, iii) Securing sufficient space for cargo handling and storage, iv) Improving efficiency of cargo handling, v) Improvement of the Environment, vi) Accommodating larger vessels, vii) Improvement of navigational safety, viii) Securing the future development space	
Phase of the Project		Based on degree of urgency, the priority projects are classified into two phases; I) **Short-Term Projects** to be implemented in the short term, II) **Long-Term Projects** to be implemented in the long term	
		II) Long-Term Project	
Project Name		**G**	**H**
		Expansion toward the Northern Area	Inter-connection of internal roads with the Maduravoyal elevated road project
Target		vii) Securing future development space	i) Normalization of traffic flow inside the Port
Purpose		/To expand the northern area of the port as a strategic project for securing competitiveness, attracting port users and leading to the future generation of the port	/To improve the traffic flow and ease congestion inside the Port (Furthermore to ease congestion outside the port)
Scope		/To develop large scale berths with the depth of 18m together with handling yard, a breakwater and channel for accepting world's largest class cruise and container vessels	Option H-2: the flyover section of Option A-2 is to be connected directly with Maduravoyal elevated road (length of the flyover section is about 3.9km) (further idea: city traffic is to be allowed to pass through the Maduravoyal elevated road using the flyover section of the port.)
Rationale		(refer to the Interim Report)	(refer to the Interim Report)
Construction Period/Cost		Period : Approximately 36 months Cost: Approximately USD 390 M .	Period: Approximately 36 months Cost: Approximately USD 236 M
Prescreening		(refer to the Interim Report)	(refer to the Interim Report)
Project Effects	**Quantitative Effect**	/Income from handling container (under the assumption that one of target cargoes is containers)	(refer to Project A)
	Qualititative Effect	/Strengthening of competitiveness /Making the port more attractive to users /Expansion of business oportunities /Development of the hinterland economy	/Normalization of the traffic flow /Reduction of congestion outside the port /Development of the hinterland economy
Issues for Implementation		/This project is proposed from the long term point of view; therefore preparations should start from now. /Grasping the timing and volume of potential cargo is important /Further technical study is needed (specifically to grasp wave conditions) /Future dirction of development and the intention of the Navy should be considered	In addition to the issues of Projct A, /Further study on project effects and implementation scheme is needed

ExchangeRate; 110yen/USD
Exchange Rate: 62.5Rp/USD

5-2-5. Challenges in infrastructure development

In order to contribute to modernization of port operation through improvement of infrastructure, the priority projects A to H are proposed. Among these priority projects, A to F can be categorized as short-term projects while G and H can be categorized as long-term projects. In order to implement these projects, the following issues must be addressed.

(1) Construction schedules

The proposed priority projects are mainly redevelopment projects which will improve and realign the existing facilities. Redevelopment projects require that alternative facilities be available for maintaining functions during construction. Therefore coordination among the existing facilities and planned facilities is a must in terms of construction schedules.

(2) Future demand

Changes in the external environment such as ban on coal handling and growth of ports in the vicinity such as Kattupalli and Kamarajar have been observed; therefore, it is necessary to consider the future demand precisely and determine construction timings and schedules properly.

(3) Collection of necessary data

For the smooth implementation of projects, data such as soil test etc. needs to be acquired and be reflected in facility planning and structure design. At Chennai port, it is necessary to carry out construction works while the port is in operation; therefore, the work should be carefully planned beforehand based on sufficient data in order to avoid unexpected circumstances which could affect operations.

(4) Necessity of further study

The proposed projects are not examined on the basis of detailed surveys or tests mentioned above; only the outlines of these projects are depicted. It should be recognized that it is necessary to implement detailed studies prior to the commencement of the projects in the future.

(5) Funding

Various domestic and international funding sources should be examined in order to finance the proposed projects. Financing by government and introduction of private funding such as PPP scheme are mentioned as examples.

Chapter.6 Conclusion

The Project on Improvement of Chennai Port Operation started in July 2014; it was divided into Phase I and Phase II and was conducted over a period of three years. The Team was dispatched to Chennai twelve times (each visit lasted approximately one month) and conducted a variety of activities related to congestion alleviation including proposals on IT and infrastructure related projects. The Team conducted its work in cooperation and collaboration with ChPT, concerned authorities and stakeholders throughout the Project.

Congestion at large scale container terminals has become a common and serious issue all over the world. On the other hand, congestion is a complicated phenomenon in which many factors are intertwined. In addition, many parties are involved in generating congestion.

The port of Chennai is located just in front of Chennai city as though it is a part of the urban area; therefore, available space for port activities is limited and container trailers are only allowed to pass through “Port Gate No.1” located along the north edge of the port despite the fact that there are many gates along the port premises. In addition, after entering Port Gate No.1, a trailer has to pass another terminal gate before arriving at the container yard. This situation makes it difficult to alleviate congestion. Furthermore, trailers usually have to stop by a CFS/CWC which is located in the north part and/or the north-western part of Chennai port, and concerned authorities related to road development and traffic control belong to the state government and entry/exit control is managed by CISF. Accordingly, various parties are involved in congestion related issues.

Under such conditions, the Team placed priority on grasping the actual status of congestion and understanding the underlying causes of congestion in order to tackle this complicated issue. The Team members observed the congestion status inside/outside the port almost every day during their stay in Chennai and have surveyed items related to congestion by hiring surveyors. These continuous observations and surveys have helped the Team to understand the congestion phenomenon and propose congestion alleviation measures. The Team introduced the PDCA (Plan-Do-Check-Act) cycle method which proved useful for tackling congestion issues. Using the PDCA method, the Team initially grasped the causes of congestion, proposed congestion measures, then confirmed their effectiveness through demonstration trials and finally proposed improvement measures toward the next step.

The Team held the steering committee (S/C) which was composed of concerned parties at every dispatch and discussed measures for congestion alleviation proposed by the Team. The steering committee has been an effective vehicle for sharing information among concerned parties and implementing measures on congestion alleviation. Upon the request of the Team, ChPT invited state government officials from the road department and traffic police to participate in the S/C. Their participation was very meaningful in allowing congestion alleviation measures to go ahead and in promoting cooperation and collaboration among concerned parties to tackle congestion issues.

The congestion alleviation activities conducted by the Team in collaboration with ChPT and concerned parties obtained positive results to a substantial extent. Japanese companies in Chennai and Bengaluru as well highly evaluated the efforts made to reduce congestion. In addition, staff of ChPT showed a willingness to collaborate with concerned parties toward solving congestion alleviation issues.

However, while great strides have been made since the initial stage of the project, congestion is still observed inside/outside the port. Therefore, ChPT in collaboration with concerned parties needs to tackle congestion issues by conducting a variety of measures.

Effects of measures conducted, remaining issues and recommendations toward the next step are presented in Chapter 4. Even though this project has come to an end, we would like to encourage ChPT to conduct continuous observations and surveys to grasp the congestion phenomenon. As the congestion phenomenon is a complicated one, ChPT will likely need to implement various measures simultaneously and establish a sustainable system in order to implement such measures continuously. For this purpose, the Team strongly suggested the establishment of sustainable systems through preparing some TORs.

In Chapter 5 the Team proposes some IT-related and infrastructure projects in order to modernize Chennai port operations. It is thought that these projects will help Chennai port retain its position as the driving center of economic growth in the south-east region of India. Considering the present situation of Chennai port and the new development policy by the government of India called "Sagarmala[3] Project", most of the projects proposed are intended to improve and/or upgrade the existing facilities and areas and to increase the port's competitiveness.

There are, of course, some issues in implementing congestion alleviation measures continuously and implementing projects for the modernization of port operations; however, it is hoped ChPT will tackle those issues in cooperation and collaboration with concerned parties.

[3] The Sagarmala is a policy initiative formulated in 2016 by the Government of India. The overall objective of the project is to evolve a model of port-led development, whereby ports become a major contributor to the country's GDP.

- Main Report -

Contents

Chapter.1 Background and Purpose of the Project

1-1. Background of the Project

(1) Present status in and around Chennai Port

Chennai Port is located in the northern part of Tamil Nadu state in close proximity to South- East Asia. Thanks to its locational advantage, a variety of industries such as the automobile industry, machinery industry, electrical and electronic industry, etc. have located there. Many Japanese companies have also expanded their businesses to this area. The number of Japanese companies with operations in Tamil Nadu state is 582 as of January 2017, the second largest in India. Tamil Nadu state is also designated as a part of the Chennai - Bengaluru Industrial Corridor and further economic development is expected in future.

(2) Present status of Chennai Port

Chennai Port plays a strategic role in marine transportation to Far East Asia and South East Asia. Many Japanese companies are located in the vicinity of Chennai area; therefore Chennai Port plays a vital role for the Japanese companies.

Chennai Port is one of 13 major ports managed by the Ministry of Shipping (MOS) of the central government. It handled 1,565 thousand TEUs in fiscal year 2015 which ranked second among major ports (although it would rank third if non-major ports are included). Total handling volume was around 50 million tons in fiscal year 2016.

Table 1-1 Trend of Cargo Handling Volumes

(IN '000 Tones)

Cargo	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
P.O.L	12,794	13,112	13,425	13,882	13,295	13,425	12,784	12,736	11,890	13,597
IRON	10,815	8,247	7,882	2,176	97	52	0	146	0	0
Fertilizer	882	761	591	776	633	421	415	541	260	268
Coal	3,990	4,684	3,362	2,503	961	0	0	0	0	0
Container	18,049	20,581	23,476	29,421	30,075	29,708	28,330	29,945	30,210	28,850
Other	10,624	10,106	12,321	12,702	10,646	9,798	9,576	9,173	7,700	7,499
Total(Tons)	**57,154**	**57,491**	**61,057**	**61,460**	**55,707**	**53,404**	**51,105**	**52,541**	**50,060**	**50,214**

Source:2007-2016;Indian Ports Association
Supplement:2007(Apr 2007 to Mar 2008)

On the other hand, Chennai Port has some serious problems which are derived from it being an old port adjacent to a large city. Heavy congestion of container trailers inside and outside the port has a negative impact on the region’s economy. Furthermore, low-use areas exist inside the port and cargo handling efficiency is low due to narrow spaces behind berths.

(3) Technical Assistance by JICA

Based on the circumstances above, JICA conducted the study entitled "Data Collection Survey on the Improvement of Port Operation in Chennai Port and Ennore port" from October 2013 to February 2014. Responding to several recommendations made in that study, JICA conducted "the Project on Improvement of Chennai Port Operation" (hereinafter referred to as "Technical Assistance Phase I") from July 2014 to September 2016; the counterpart agency was Chennai Port Trust (ChPT). This technical assistance project was conducted in order to improve overall port operation, particularly by focusing on measures to alleviate traffic congestion.

In this project, a variety of activities conducted such as grasping the congestion status, analyzing congestion, utilizing IT technology and sharing information among stakeholders, and so in collaboration with ChPT and concerned organizations.

(4) Remaining issues and challenges

Many positive outcomes were generated through Technical Assistance Phase I. For example, the congestion status outside the port has been improved, transaction time at Port Gate No.1 has been shortened and lead time from CFSs to Port Gate No.1 has been reduced. However, because ChPT does not have sufficient experience to tackle difficult issues such as information sharing utilizing IT related technologies by themselves, technical assistance is still required in order to improve and modernize port operations.

Furthermore, as Kamarajar port, Kattupalli port and other ports located near Chennai Port have been upgrading their facilities, Chennai Port needs to not only improve operational efficiency but also modernize its facilities in order to remain competitive. ChPT requested a study on the improvement and development of port facilities.

Based on the background mentioned above, the Project on Improvement of Chennai Port Operation Phase II (hereinafter referred to as "the Phase II project") has been conducted.

1-2. Purpose of the Project

The purpose of this Project (which is a continuation of the Phase I project) is as follows.

i) To enhance the efficiency of the operation of Chennai Port by reducing container movement lead times through following up the activities taken in Technical Assistance Phase I and entrenching congestion alleviation measures to the counterpart agency (ChPT).
ii) To examine the validity and effectiveness of possible port infrastructure projects (including IT related projects) through collecting and analyzing relevant information and data.

1-3. Areas of the Project

Chennai Port and its surrounding area

1-4. Counterpart and Implementing Agencies

Counterpart	Chennai Port Trust (ChPT)
Central Government	Ministry of Shipping (MOS)
State Government	Tamil Nadu State
Concerned Organizations	Chennai Chapter of National Association of Container Freight Station (NACFS), Central Warehouse Corporation (CWC), Customs (CBEC: Central Board of Excise and Customs), Central Industrial Security Force (CISF), Trailers Association (Owners and Drivers), etc.

Chapter.2 Team Members and Dispatch Schedule

2-1. Composition of the Team

The JICA Study Team (hereinafter referred to as "The Team") was composed of the following members.

Assigned Area	Name	Organization
Leader / Port Planning	Akira KOYAMA	The Overseas Coastal Area Development Institute of Japan (OCDI)
Modernization of Port Facility (1)	Ryuichi KUWAJIMA Takahiro SUZUKI (from July 2017)	OCDI
Modernization of Port IT System (1)	Norihiro FUKAZAWA	Mitsui Engineering & Shipbuilding Co., Ltd.
Modernization of Port IT System (2)	Hiroshi KIMOTO	Hakata Port Terminal CO., Ltd.
Modernization of Port Facility (2)	Osamu KUNITA	OCDI
Environmental and Social Considerations	Shane REID	OCDI
Traffic Survey	Eiji HASEBE	OCDI
Modernization of Port Facility (3) / Administrative Coordinator	Yoshikazu OSHIKAWA	OCDI

2-2. Dispatch Schedule of the Team

Dispatch schedule of the Team up to the first half of the Phase II project is shown below.

Dispatch Number	Schedule
First（Ninth）Dispatch	Sunday, 12th February – Saturday, 11th March, 2017
Second（Tenth）Dispatch	Sunday, 23rd April – Saturday, 20th May, 2017
Third (Eleventh) Dispatch	Sunday, 23rd July – Saturday, 19th August, 2017
Fourth (Twelfth) Dispatch	Tuesday, 10th Oct. – Tuesday, 31st Oct, 2017
Fifth (Thirteenth) Dispatch	Sunday, 3rd Dec. – Sunday, 10th Dec.

Note: Number in parenthesis means the total number of dispatches from the Phase I project. This number is used in this report. Dispatch schedule includes traveling days. Schedule of each member may vary.

Note: The 5th dispatch was not scheduled in the original dispatch plan. Two (2) team members (the Team Leader and the member in charge of IT System Improvement (1)) were dispatched for eight (8) days in order to submit the revised draft final report and the Team's reply to comments from ChPT. The two members also reported the results of this study to Japanese companies stationed in Chennai.

Chapter.3 Major Activities and Results

3-1. Outline of Project Activities

The entire activities planned during the Phase II project and the relation between the Phase I and Phase II projects are as follow.

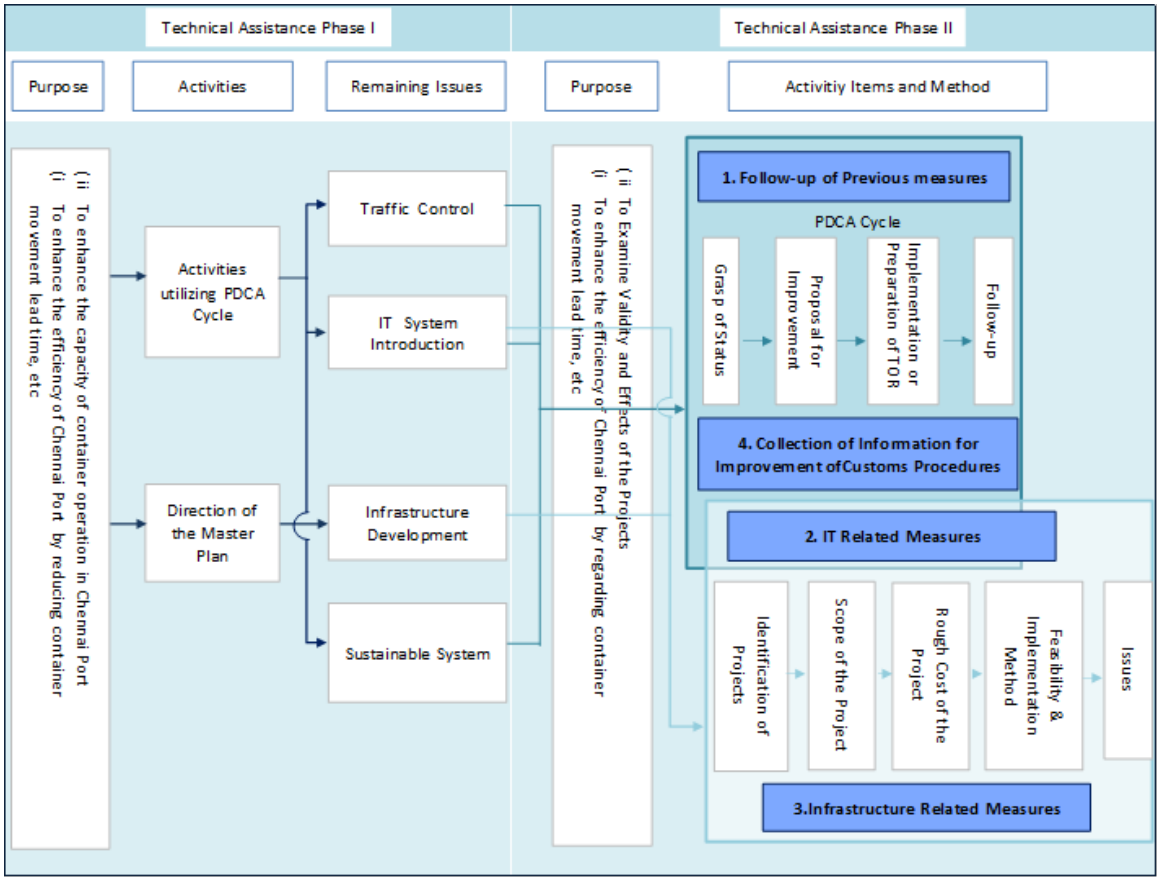


Figure 3-1 Entire Activities of the Technical Assistance

(1) Follow-up of Previous Measures for Improvement of Port Operation

The Team has been following up the several surveys and activities conducted during the Phase I project for further optimization of the flow of trailers. The Team has also been supporting the measures to be conducted by ChPT and regulatory authorities concerned.

The Team has continued to conduct these surveys and activities after observing each site again and making the necessary modifications when circumstances have changed.

(2) Modernization of Port Operation I (IT related Measures)

The utilization of IT is essential for modernizing Chennai Port operations. The Team has continued to promote the introduction of a system utilizing IT, as it contributes not only to the alleviation of the traffic congestion but also to the operational improvements of the whole Port.

(3) Modernization of Port Operation II (Infrastructure related Measures)

The Team has been examining measures on how to improve and develop port facilities for modernization of Chennai Port. In addition, ChPT requested the Team to examine the priority of the projects which the Team proposed in the Phase I project. The Team has continued to examine the priority and feasibility of the projects based on the previous discussions with ChPT. Specifically; competitive ports have been emerging around Chennai Port. To continue playing an important role in the region, the facilities of Chennai Port needs to be improved. Therefore the Team has proposed measures to ensure that Chennai Port remains competitive in future.

(4) Collection of Information for Improvement of Customs Procedures

The Customs procedure for import/export containers is one of the important issues for alleviating the traffic congestion at Chennai Port. In fact, inefficient Customs procedure is a serious problem throughout the entire country. Therefore, the Team has continued to grasp the Customs procedure inside and outside Chennai Port through observation and interviews, identify issues, examine improvement plans, and implement them through ChPT when possible.

3-2. Steering Committee

The Team has continued to support ChPT in holding a Steering Committee (S/C) in order to implement the project and make proposals.

Date and agenda of the previous S/C are as follows.

1) S/C of the 9th dispatch was held on Friday, February 17th, 2017 at the Board Room of ChPT with attendance of the Chairman, Deputy Chairman and Official of ChPT and representatives of concerned organizations. The Team explained the policy and contents of the technical assistance Phase II. Participants expressed their expectations toward the JICA's study.

2) S/C of the 10th dispatch chaired by the Traffic Manager was held on Thursday, May 18th, 2017 at the Board Room of ChPT. Officials of ChPT and representatives of concerned organizations attended the S/C. The Team explained the progress of the study on Improvement of Chennai Port Operation Phase II. Discussions were held among participants and the Traffic Manager expressed his expectations for the Interim Report by the Team. Furthermore, he expressed his intention that ChPT would like to put into practice JICA's proposals.

3) S/C was held on Thursday, August 17th 2017 at the Board Room of ChPT. Officials of ChPT and representatives of concerned organizations attended the S/C. The Chairman of ChPT chaired the meeting. The Team explained the progress of the study on Improvement of Chennai Port Operation Phase II. The discussion was mainly on the congestion issues that the Team pointed out based on their survey. The Chairman requested each stakeholder to explain the issues being faced and propose solutions. Participants were once again aware of the necessity to address the congestion issues in cooperation with related organizations.

4) A Steering Committee (S/C) was held on Thursday, October 26th 2017 at the Board Room of ChPT. Officials of ChPT and representatives of concerned organizations attended the S/C. The Deputy Traffic Manager of ChPT chaired the meeting. The Team explained the progress of the study. A stakeholder agreed with the Team that it is better to allocate waiting areas inside the port, which would add marketing value for the port in terms of trade, and also pointed out that ChPT should take necessary steps to regulate the traffic around X-ray intersections. Another stakeholder explained that the main reason for the traffic congestion up to Manali junction is due to the lack of blocks for dedicated lanes for the trailers. Participants remain keenly aware of the necessity to address the congestion issues in cooperation with related organizations.

3-3. Exchange of Opinions with the Ministry of Shipping

The Team called on the office of Mr. Saran, Deputy Secretary of the Ministry of Shipping in Delhi on Tuesday, February 28th 2017. The Team explained the positive outcomes of the Phase I project and the policy and contents of the Phase II project. Mr. Saran requested that further efforts be made to reduce congestion. He also stated that it was necessary to persuade stakeholders to cooperate fully with measures taken to combat congestion. On the other hand, regarding the projected decrease in traffic volumes in the Sagarmala Report, he said the Ministry of Shipping would continue to regard Chennai Port as an important major port.

3-4. Discussion on the Reports

(1) Discussion on the Interim Report

A meeting to discuss the Interim Report was held on Saturday, August 5th 2017 at the Board Room of ChPT. The Chairman of ChPT, the Deputy Chairman, Traffic manager, Chief Engineer, Deputy Conservator and other officials of ChPT (12 members in total) attended the meeting. The Chairman of ChPT chaired the meeting. The Team gave a presentation on the Interim Report of the Phase II project and discussed the contents of it in detail with participants.

The Chairman stated that ChPT would go through the short term plan in detail, formulate an action plan and give the Team its feedback. He also stated that improvement of the Jawahar entrance was very important among the priority projects and would like to seek JICA's assistance. The Team replied that it would discuss this matter with JICA Headquarters after returning to Japan. Furthermore, the Chairman requested the Team to work with engineers of ChPT to examine this project deeper and to refine the environment improvement projects.

The meeting lasted two hours after which the Chairman thanked the Team for its efforts.

(2) Discussion on the Draft Final Report

A meeting to discuss the Draft Final Report was held on Tuesday, October 24th 2017 at the Board Room of ChPT. The Chairman of ChPT, Traffic manager, Chief Engineer, and other officials of ChPT

(8 members in total) attended the meeting. The Chairman of ChPT chaired the meeting. The Team gave a presentation on the Draft Final Report of the Phase II project and discussed the contents of it in detail with participants.

The Chairman noted the need for effective countermeasures in order to reduce traffic congestion, while the Team emphasized the importance of the PDCA (Plan-Do-Check-Action) cycle with monitoring and evaluating specific indexes. Furthermore, the Chairman requested the Team to explain in detail the Team's proposal about the improvement of the Jawahar entrance and the environment improvement projects to the officials of the engineering department. The Chairman stated that ChPT would compile comments on the Draft Final Report and send them to the Team by November 15th 2017. The meeting lasted one and half hours after which the Chairman thanked the Team for its efforts.

(3) Submission of the Revised Draft Final Report

The Team submitted the Revised Draft Final Report and the Team's reply to the comments from ChPT. The Revised Draft Final Report was submitted to the Chairman, Deputy Chairman, Traffic Manager, and Chief Engineer, etc. respectively. Some executives of ChPT stressed that ChPT would continue to examine certain projects in order to obtain JICA's assistance under the strong leadership of the Chairman.

(4) Explanation of the outcomes of the study to Japanese companies

The Team reported the results of the study to Japanese companies in Chennai on Monday, 4th December 2017. The Team has explained the contents and progress of the study and exchanged views with the members of the Road and Port Infrastructure Committee of the Japan Chamber and Commerce in Chennai whenever the Team was dispatched to Chennai. As this was the final dispatch, the committee hosted an explanatory meeting and the Team explained the contents of the activities and the outcomes of the study. The members appreciated the efforts of the Team and expressed their expectations that ChPT would make continuous efforts to improve their port operation.

3-5. Following-up of the Technical Assistance (Part 1)

3-5-1. Port Activities

(1) Cargo handling trends

The total handling volume increased from 2007 to 2010 but has shown a tendency to decline since 2011. However, among major cargoes, container cargo is stable and its proportion to the total handling volume has also been increasing; containers accounted for 57.0% of the total cargo in 2014, 60.3% in 2015 and 57.5% in 2016. Handling volume of P.O.L is stable, while cargo handling of coal and iron ore has been suspended due to environmental concerns and the government's embargo on exports.

Table 3-1 Major Cargo Handled at Chennai Port

(IN '000 Tones)

Cargo	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
P.O.L	12,794	13,112	13,425	13,882	13,295	13,425	12,784	12,736	11,890	13,597	6,222
IRON	10,815	8,247	7,882	2,176	97	52	0	146	0	0	0
Fertilizer	882	761	591	776	633	421	415	541	260	268	168
Coal	3,990	4,684	3,362	2,503	961	0	0	0	0	0	0
Container	18,049	20,581	23,476	29,421	30,075	29,708	28,330	29,945	30,210	28,850	11,970
Other	10,624	10,106	12,321	12,702	10,646	9,798	9,576	9,173	7,700	7,499	6,058
Total(Tons)	**57,154**	**57,491**	**61,057**	**61,460**	**55,707**	**53,404**	**51,105**	**52,541**	**50,060**	**50,214**	**24,418**

Source:2007-2016;Indian Ports Association
2017;Chennai Port Trast HP
Supplement:2007(Apr 2007 to Mar 2008)
& 2017(Apr to Sep)

(2) Container handling trends

Container handling volume of Chennai port for the last four years has been fluctuating at around 1.5 million TEUs. In FY 2015, the handling volume reached a maximum of 1,557 thousand TEUs. However, the volume decreased to 1,485 thousand TEUs in FY 2016. In the first half of FY 2017, the volume increased by 5.5 % compared to the same period of the last fiscal year.

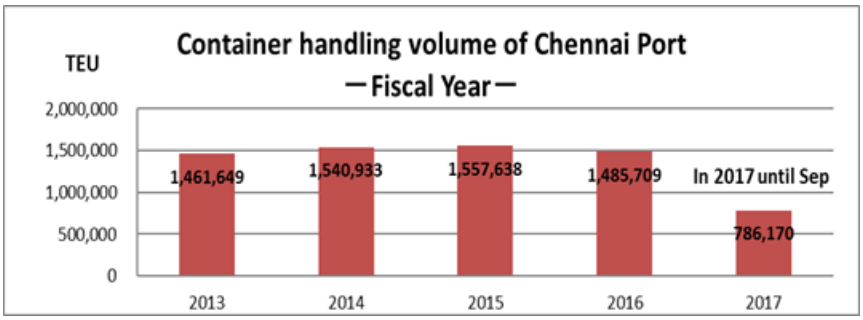


Figure 3-2 Container Handling Volume at Chennai Port (Fiscal Years (FY) base)

Table 3-2 Container Handling Trend by Import and Export

DPW + PSA		Import (TEU)		Export (TEU)		Tranship (TEU)	Total (TEU)
		Laden Container	Empty Container	Laden Container	Empty Container		
2013 - 2014 (FY)	April	61,964	2,376	46,460	8,902	2	119,704
	May	62,212	1,623	46,070	13,543	1	123,449
	June	64,274	1,754	47,958	12,674	2	126,662
	July	63,645	2,452	50,547	14,539	20	131,203
	August	62,278	2,924	49,984	13,260	0	128,446
	September	59,484	3,408	52,994	8,105	9	124,000
	October	57,226	3,271	51,100	11,304	42	122,943
	November	53,791	3,445	47,035	7,285	6	111,562
	December	57,916	3,388	53,181	6,828	2	121,315
	January	56,688	4,234	47,716	6,942	6	115,586
	February	47,905	4,346	50,113	6,028	6	108,398
	March	57,093	6,958	59,890	4,436	4	128,381
	Total(13-14)	704,476	40,179	603,048	113,846	100	1,461,649
2014 - 2015 (FY)	April	59,196	5,492	49,962	4,046	1	118,697
	May	65,385	3,504	55,705	6,933	2	131,529
	June	66,417	4,759	47,376	9,039	4	127,595
	July	67,652	3,228	54,756	14,069	2	139,707
	August	65,520	4,445	53,746	10,795	0	134,506
	September	68,962	4,196	53,241	9,904	3	136,306
	October	61,104	4,100	51,047	13,029	1	129,281
	November	59,181	3,704	47,934	12,353	76	123,248
	December	60,318	5,635	53,775	14,202	506	134,436
	January	60,108	3,993	48,020	9,550	174	121,845
	February	53,292	4,294	49,047	6,443	2	113,078
	March	61,010	6,515	55,021	8,335	212	131,093
	Total(14-15)	748,145	53,865	619,630	118,698	983	1,541,321
2015 - 2016 (FY)	April	70,746	4,051	51,416	11,088	0	137,301
	May	65,947	3,896	43,573	15,648	0	129,064
	June	67,634	3,901	45,115	12,076	0	128,726
	July	68,875	3,386	50,554	19,272	0	142,087
	August	60,468	5,147	47,761	14,489	0	127,865
	September	65,328	6,967	47,938	13,699	572	134,504
	October	60,668	7,650	45,768	14,988	655	129,729
	November	60,557	3,853	36,642	10,819	400	112,271
	December	62,057	2,960	43,151	11,825	2,000	121,993
	January	64,028	4,416	44,950	15,695	2	129,091
	February	55,803	3,077	46,002	12,777	0	117,659
	March	73,269	3,818	54,774	15,486	1	147,348
	Total(15-16)	775,380	53,122	557,644	167,862	3,630	1,557,638
2016 - 2017 (FY)	April	65,544	4,164	40,729	14,111	40	124,588
	May	66,602	2,869	33,366	16,301	0	119,138
	June	72,208	2,909	35,772	21,622	268	132,779
	July	68,996	2,362	33,205	21,107	331	126,001
	August	65,676	2,578	36,800	21,504	518	127,076
	September	60,127	3,651	27,528	22,014	2,279	115,599
	October	66,841	3,915	35,530	19,133	859	126,278
	November	72,458	4,827	36,111	21,404	249	135,049
	December	58,906	2,161	34,632	16,392	0	112,091
	January	68,981	3,791	36,528	19,566	0	128,866
	February	53,986	1,666	37,602	12,721	2	105,977
	March	74,045	3,495	41,568	13,159	0	132,267
	Total(16-17)	794,370	38,388	429,371	219,034	4,546	1,485,709
2017 - 2018 (FY)	April	73,156	2,564	36,181	18,644	0	130,545
	May	68,169	2,226	33,265	21,478	0	125,138
	June	74,259	3,315	33,724	24,806	0	136,104
	July	75,460	3,931	35,377	17,546	76	132,390
	August	73,076	2,937	36,413	20,936	0	133,362
	September	71,918	2,409	34,590	19,714	0	128,631
	Total(17-18)	436,038	17,382	209,550	123,124	76	786,170

Source: ChPT

The handling share between DPW/CCTL and PAS/CITPL has recently fluctuated. The handling share of DPW, which previously exceeded 50%, has decreased, while that of PSA has increased. This tendency was first observed from February 2016 and has remained unchanged. The latest statistics show that share differences between PSA and DPA are becoming larger.

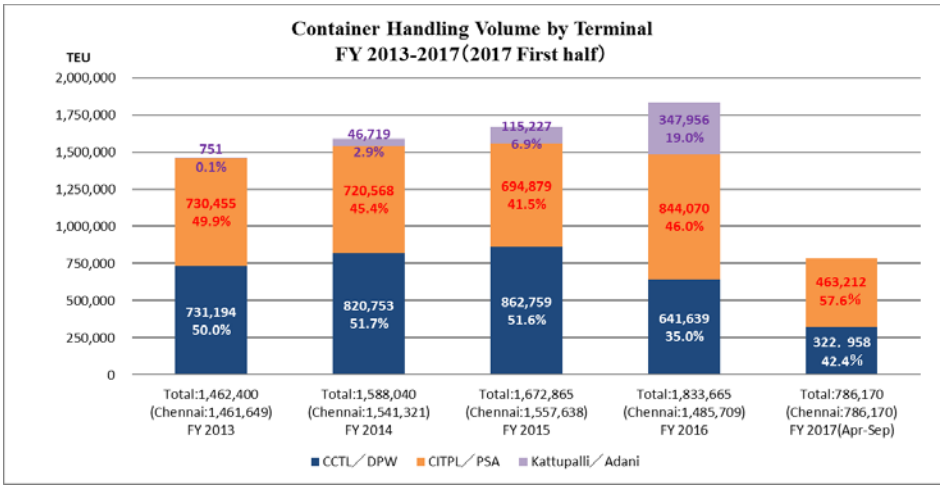
Table 3-3 Container Handling Volumes by Terminal

		Total	DPW (CCT)		PSA (CITPL)	
		Number of container (TEU)	Number of container(TEU)	share(%)	Number of container(TEU)	share(%)
2013	Total(13-14)	1,461,649	731,194	50.0%	730,455	50.0%
2014	Total(13-14)	1,541,321	820,753	53.2%	720,568	46.8%
2015	Total(13-14)	1,557,638	862,759	55.4%	694,879	44.6%
2016	Total(13-14)	1,485,709	641,639	43.2%	844,070	56.8%
2017 - 2018 (FY)	April	130,545	51,642	39.6%	78,903	60.4%
	May	125,138	49,764	39.8%	75,374	60.2%
	June	136,104	54,108	39.8%	81,996	60.2%
	July	132,390	54,507	41.2%	77,883	58.8%
	August	133,362	58,427	43.8%	74,935	56.2%
	September	128,631	54,510	42.4%	74,121	57.6%
	Total(17-18)	786,170	322,958	41.1%	463,212	58.9%

Source: ChPT

There are three container handling ports in the northeastern area of Tamil Nadu state and each is located in close proximity to one another. Container demand in the entire Chennai area has recently been increasing. Total number of handling containers reached 1,833 thousand TEUs in FY 2016 which represents an annual growth rate of 7.8% for the last three years. Container handling volume of Chennai port is stable at about 1,500 thousand TEUs while that of Kattupalli port has rapidly increased and reached to about 300 thousand TEUs in FY 2016. The increase in container demand in this area seems to be being captured by Kattupalli port.

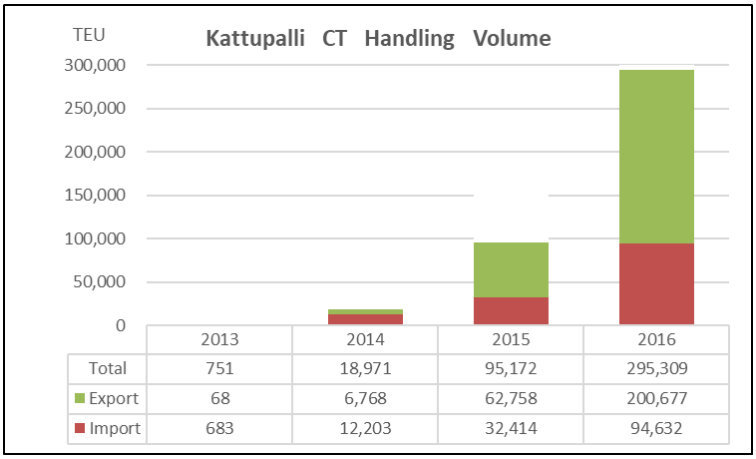
On the other hand, Kamarajar container terminal commenced its operations in early July 2017, but no container ship has called by the end of October.



Source: ChPT and Kattupalli port

Figure 3-3 Container Handling Volume by Terminal in the Chennai Region (Fiscal Year: FY)

Handling volume of Kattupalli port increased by more than 200% from CY 2015 to CY 2016; it now handles approximately 16% of the total handling volume in the region. Unlike Chennai Port where import containers are predominant, Kattupalli port is characterized by a large share of export containers (nearly two-thirds of the total). Kamarajar container terminal is operated by the Adani group; therefore, a substantial volume of container cargoes might be handled even at Kamarajar port in near future due to the Adani group's aggressive marketing activities.



	2013	2014	2015	2016
Total	751	18,971	95,172	295,309
Export	68	6,768	62,758	200,677
Import	683	12,203	32,414	94,632

Figure 3-4 Container Handling Volume at Kattupalli Port by Export/Import

3-5-2. Port Congestion Survey

(1) Regular congestion survey

The Team conducted a daily traffic congestion survey outside the port at each dispatch. The survey consisted of recording the number of queuing trailers as well as identifying the ending point of the queue and observing the status of TVT-Parking.

Explanation: Ending Point of the Queue

Port Gate No.1 is referred to as Point O while the entrance of the access road is indicated as Point 1.

Other major points are denoted as follows:
Point 5: TVT-Parking
Point 7: Bharath Nagar Intersection
Point 9: Manali Intersection

Figure 3-5 Checkpoints of the Congestion Survey

The number of queuing trailers during the 9th dispatch is shown below.

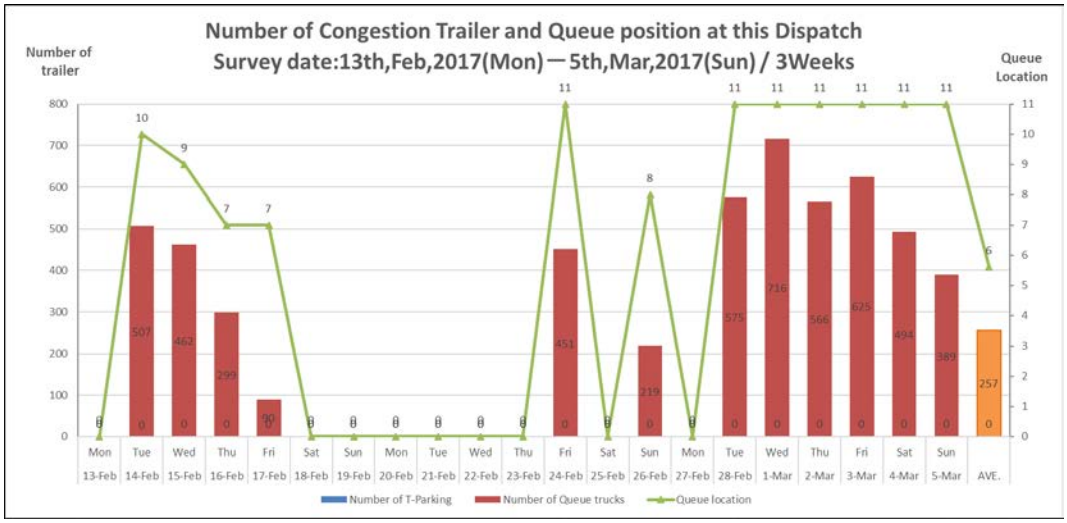


Figure 3-6 Number of Queuing Trailers outside the port (9th Dispatch)

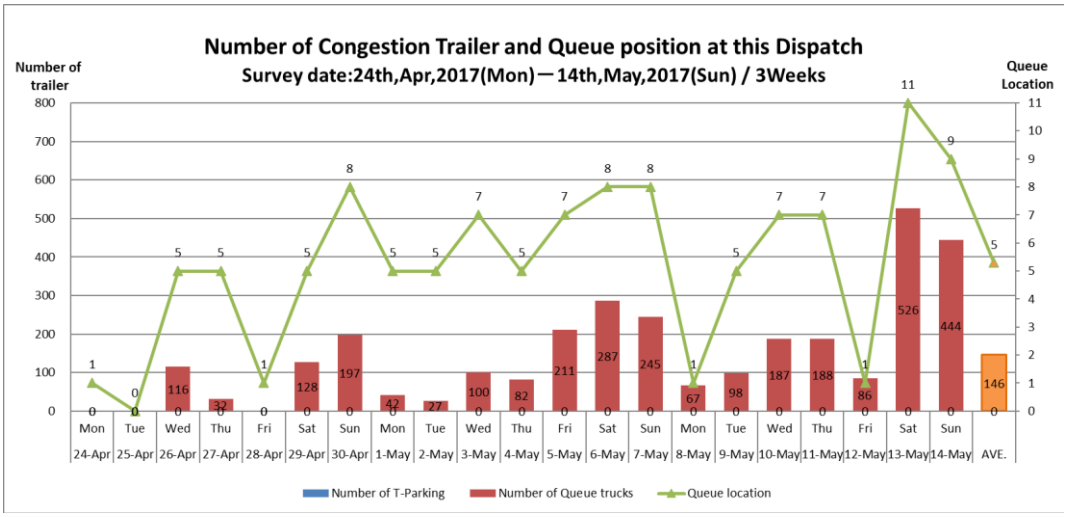


Figure 3-7 Number of Queuing Trailers outside the Port (10th Dispatch)

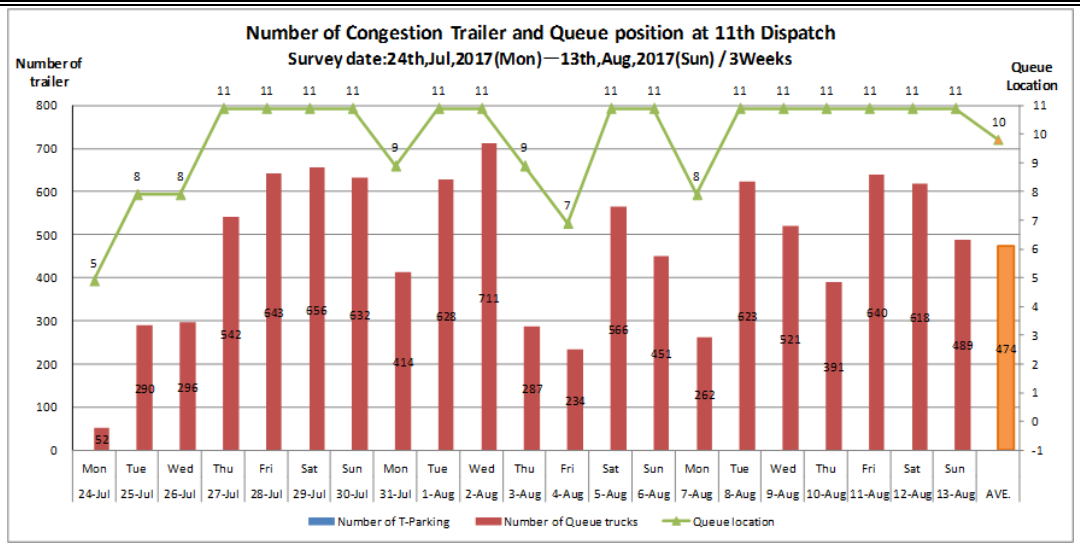


Figure 3-8 Number of Queuing Trailers outside the Port (11th Dispatch)

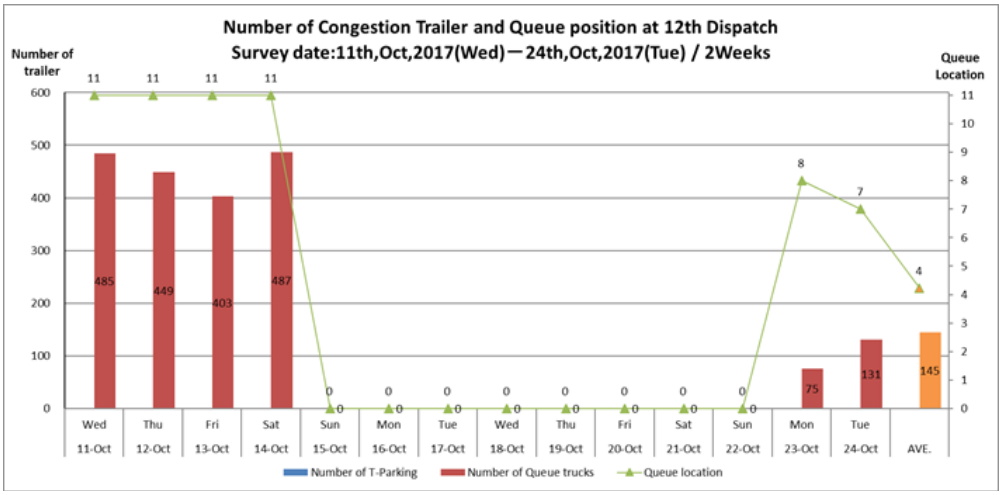


Figure 3-9 Number of Queuing Trailers outside the Port (12th Dispatch)

The general tendency of the status of congestion outside the port obtained during the Phase I project was that congestion was heavier from Wednesday and reached a peak at the weekend. Congestion became slight from the afternoon of Sunday to Monday and then became gradually heavier from Tuesday. However, a specific tendency such as the above was not observed during the Phase II project. The reasons for the lack of a clear tendency are thought to be changes in the container handling volume rate between CTL and CICPL, changes in calling schedule of container vessels, the diversion of some export containers to Kattupalli port and so on.

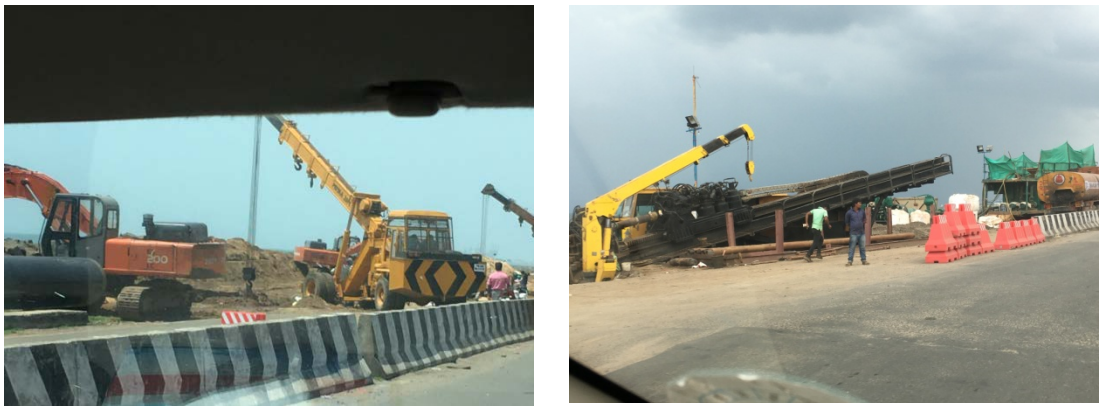
The features of congestion are as follows. The number of queuing trailers during the 10th dispatch was relatively small; however during other dispatches, more than 600 queuing trailers were observed several times and in such cases queues were extended toward the west area of the Manali junction (Point No. 11). Construction work on the buried pipeline along SH 114 from Chennai port to the oil refinery near the Manali area during the 11th dispatch is thought to be one of the causes as most sections of the dedicated lanes for trailers could not be used which disrupted the normal traffic flow.

Survey duration of the 12th dispatch was relatively short (two weeks). As Diwali (18th October) which is a Hindu holiday was included among survey days, survey results were different from the previous results. The average number of queuing trailers before the Diwali period (from 11th to 14th October) was around 450 while that of the Diwali week became zero (0).

During the Diwali week, the number of queuing trailers was zero (0), while the number of trailers passing through Port Gate No.1 was nearly the same as usual. The number of ordinary vehicles is thought to significantly decrease during the Diwali week. Diwali was experienced two times in the previous dispatch; however as congestion remained unchanged on those occasions, the status of congestion observed at this dispatch may be an anomaly.

As pipeline burying works had not progressed much and construction materials and machines were blocking sections of roads, the dedicated lanes for trailers could not perform their function.

Many parked trailers were observed to occupy the dedicated lanes of SH114 near Observation Point No.4. Traffic police must warn trailer drivers that parking is prohibited on the dedicated lanes.



Picture 3-1 Pipeline Burying Works along SH114

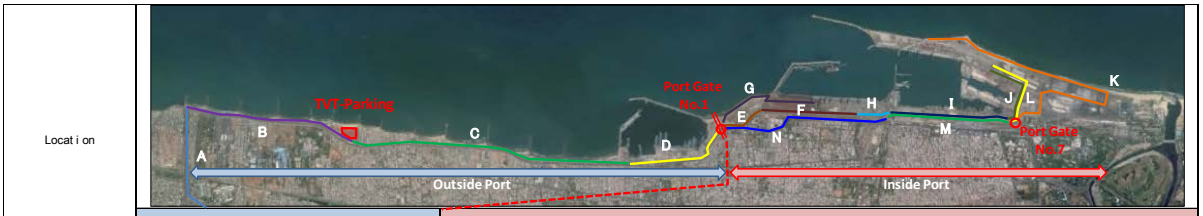
Picture 3-2 Double and/or Triple Queues along SH114 (left) and SH56 (right)

(2) Congestion status inside /outside the port

The Team analyzed the congestion status inside and outside the port by dividing the area into 12 sections and identified the bottlenecks of the congestion. A to D are sections outside the port and E to

L are section inside the port.

Results of the congestion status inside and outside the port from the 9th to the 12th dispatch is as follows



Location			Outside Port				Inside Port									
			A	B	C	D	E	F	NEW G	H	I	J	NEW K	L	M	N
Date	Week	Time	beyod Bharath Nagar Point	Bharath Nagar Point ~ TVT-Parking	TVT-Parking ~ Access Road Entrance	Access Road Entrance ~ **Port Gate 1**	Port Gate 1 ~ X-Ray Intersection	X-Ray Intersection ~ **DPW Entrance**	Port Gate 1 ~ **DPW North Gate** (without Container)	DPW Entrance ~ DPW Exit	DPW Exit ~ Port Gate 7	Port Gate 7 ~ **PSA Entrance**	Port Gate 7 ~ **PSA Entrance** (without Container)	PSA Exit ~ Port Gate 7	Port Gate 7 ~ DPW Exit	DPW Exit ~ Port Gate 1 (Exit)
24th Apr	Mon	15:00	nil	nil	nil	nil	nil	nil	short	nil	nil	nil	short	nil	nil	nil
25th Apr	Tue	***	???	???	???	???	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
26th Apr	Wed	11:30	nil	nil	long	long	nil	nil	short	nil	nil	long	long	nil	nil	nil
27th Apr	Thu	15:30	nil	nil	short	short	nil	nil	long	nil	nil	short	long	nil	nil	nil
28th Apr	Fri	15:30	nil	nil	nil	short	nil	nil	long	nil	nil	long	long	nil	nil	long
29th Apr	Sat	16:00	nil	nil	long	long	nil	nil	short	nil	nil	nil	long	nil	nil	short
30th Apr	Sun	11:30	short	long	long	long	nil	long	short	nil	nil	short	long	nil	nil	long
1st May	Mon	13:30	nil	nil	long	long	long	nil	long	nil	nil	nil	short	nil	nil	long
2nd May	Tue	16:00	nil	nil	nil	short	nil	nil	short	nil	nil	nil	short	nil	nil	short
3rd May	Wed	14:30	nil	short	long	long	nil	nil	short	nil	nil	long	short	nil	nil	nil
4th May	Thu	15:00	nil	nil	long	long	nil	nil	short	nil	nil	long	long	nil	nil	short
5th May	Fri	14:30	nil	long	long	long	nil	nil	long	l	nil	short	long	nil	nil	short
6th May	Sat	15:30	long	long	long	long	nil	nil	short	nil	nil	long	long	nil	nil	short
7th May	Sun	11:30	long	long	long	long	???	long	long	short	long	long	long	nil	nil	long
8th May	Mon	15:30	nil	nil	long	long	???	???	short	short	nil	short	long	nil	short	long
9th May	Tue	15:00	nil	nil	long	long	nil	nil	nil	nil	nil	long	long	nil	nil	nil
10th May	Wed	13:30	nil	long	long	long	nil	nil	nil	nil	nil	long	long	nil	nil	nil
11th May	Thu	15:00	nil	short	long	nil	nil	nil	short	nil	short	long	long	nil	nil	nil
12th May	Fri	15:00	nil	nil	long	long	nil	nil	nil	nil	short	long	long	nil	nil	nil
13th May	Sat	13:00	long	long	long	long	???	???	???	nil	nil	long	long	nil	nil	long
14th May	Sun	12:00	long	long	long	long	short	long	nil	nil	nil	nil	nil	nil	nil	short

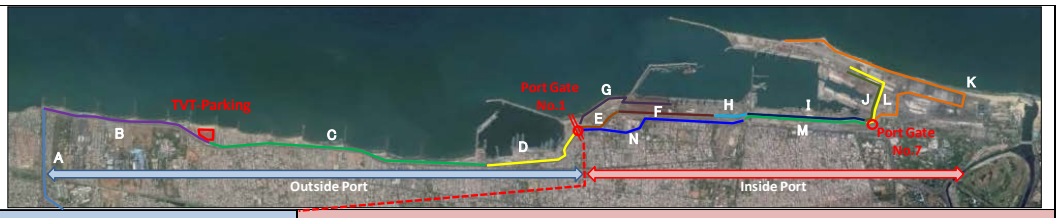
Truck Queue : nil, short (less than 30), long (30 or more),

Figure 3-10 Congestion Status inside/outside the Port (9th Dispatch)

In terms of the overall state of congestion inside and outside the port, congestion from Port Gate NO.1 to the DPW IN gate was slightly reduced while congestion starting at the PSA in gate was frequently observed.

In addition, traffic from/to Dr. Ambedkar and JD Dock for transporting bulk cargo and cars, etc. blocked the flow of trailers to/from PSA terminal; therefore a new traffic rule controlling traffic flows at the intersection near Gate No.7 was introduced. When the queue starting at PSA IN gate reached a point near Port gate No.7, traffic control at Port Gate No.1 was conducted, which was a new traffic control rule. Furthermore, many parking trailers were observed on the internal roads, specifically many trailers were parked on the road from DPW OUT gate to Port Gate No.1.

Furthermore, the congestion status inside and outside the port at the 10th dispatch is as follows.



Location			Outside Port				Inside Port										
			A	B	C	D	E	F	NEW G	H	I	J	NEW K	L	M	N
Date	Week	Time	beyod Bharath Nagar Point	Bharath Nagar Point ~ TVT-Parking	TVT-Parking ~ Access Road Entrance	Access Road Entrance ~ **Port Gate 1**	Port Gate 1 ~ X-Ray Intersection	X-Ray Intersection ~ **DPW Entrance**	Port Gate 1 ~ **DPW North Gate** (without Container)	DPW Entrance ~ DPW Exit	DPW Exit ~ Port Gate 7	Port Gate 7 ~ **PSA Entrance**	Port Gate 7 ~ **PSA Entrance** (without Container)	PSA Exit ~ Port Gate 7	Port Gate 7 ~ DPW Exit	DPW Exit ~ Port Gate 1 (Exit)
24th Apr	Mon	15:00	nil	nil	nil	nil	nil	nil	short	nil	nil	nil	short	nil	nil	nil
25th Apr	Tue	***	???	???	???	???	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
26th Apr	Wed	11:30	nil	nil	long	long	nil	nil	short	nil	nil	long	long	nil	nil	nil
27th Apr	Thu	15:30	nil	nil	short	short	nil	nil	long	nil	nil	short	long	nil	nil	nil
28th Apr	Fri	15:30	nil	nil	nil	short	nil	nil	long	nil	nil	long	long	nil	nil	long
29th Apr	Sat	16:00	nil	nil	long	long	nil	nil	short	nil	nil	nil	long	nil	nil	short
30th Apr	Sun	11:30	short	long	long	long	nil	long	short	nil	nil	short	long	nil	nil	long
1st May	Mon	13:30	nil	nil	long	long	long	nil	long	nil	nil	nil	short	nil	nil	long
2nd May	Tue	16:00	nil	nil	nil	short	nil	nil	short	nil	nil	nil	short	nil	nil	short
3rd May	Wed	14:30	nil	short	long	long	nil	nil	short	nil	nil	long	short	nil	nil	nil
4th May	Thu	15:00	nil	nil	long	long	nil	nil	short	nil	nil	long	long	nil	nil	short
5th May	Fri	14:30	nil	long	long	long	nil	nil	long	l	nil	short	long	nil	nil	short
6th May	Sat	15:30	long	long	long	long	nil	nil	short	nil	nil	long	long	nil	nil	short
7th May	Sun	11:30	long	long	long	long	???	long	long	short	long	long	long	nil	nil	long
8th May	Mon	15:30	nil	nil	long	long	???	???	short	short	nil	short	long	nil	short	long
9th May	Tue	15:00	nil	nil	long	long	nil	nil	nil	nil	nil	long	long	nil	nil	nil
10th May	Wed	13:30	nil	long	long	long	nil	nil	nil	nil	nil	long	long	nil	nil	nil
11th May	Thu	15:00	nil	short	long	nil	nil	nil	short	nil	short	long	long	nil	nil	nil
12th May	Fri	15:00	nil	nil	long	long	nil	nil	nil	nil	short	long	long	nil	nil	nil
13th May	Sat	13:00	long	long	long	long	???	???	???	nil	nil	long	long	nil	nil	long
14th May	Sun	12:00	long	long	long	long	short	long	nil	nil	nil	nil	nil	nil	nil	short

Truck Queue : nil, short (less than 30), long (30 or more),

Figure 3-11 Congestion Status inside/outside the Port (10th Dispatch)

Congestion outside the port was lighter than that in previous dispatches.

On the other hand, the congestion status inside the port has significantly changed. Section G and K are new routes for empty trailers, which were introduced in the route toward DPW terminal and PSA terminal respectively. Due to the introduction of the new route toward DPW terminal and the decrease in the handling number of containers, congestion outside DPW IN gate (Section F) was seldom observed. Congestion was usually observed on the new route. However, as the new route was perfectly separated from the existing routes for trailers, congestion observed on the new route did not affect other traffic flow.

Congestion starting at PSA IN gate was still observed. A new rule calling for traffic control when congestion reaches the point near Port Gate No.7 was introduced. In addition, trailer flows from/to PSA terminal were controlled to prevent them from impeding the traffic flows from/to Jawahar Dock. However, such traffic control was not always effective when heavy congestion occurred.

Many parked trailers were still observed on the internal roads. Twofold and/or threefold parking were observed; this problem needs to be urgently addressed in order to realize a normal traffic flow.

Congestion status inside and outside the port during the 11th dispatch is shown below.

Location			Outside Port				Inside Port										
			A	B	C	D	E	F	NEW G	H	I	J	NEW K	L	M	N
Date	Week	Time	beyod Bharath Nagar Point	Bharath Nagar Point ~ TVT-Parking	TVT-Parking ~ Access Road Entrance	Access Road Entrance ~ Port Gate 1	Port Gate 1 ~ X-Ray Intersection	X-Ray Intersection ~ DPW Entrance	Port Gate 1 ~ DPW North Gate (without Container)	DPW Entrance ~ DPW Exit	DPW Exit ~ Port Gate 7	Port Gate 7 ~ PSA Entrance	Port Gate 7 ~ PSA Entrance (without Container)	PSA Exit ~ Port Gate 7	Port Gate 7 ~ DPW Exit	DPW Exit ~ Port Gate 1 (Exit)
24th Jul	Mon	16:00	nil	nil	short	long										
25th Jul	Tue	15:00	short	long	long	long	long	nil	long	nil	nil	short	short	nil	nil	short
26th Jul	Wed	16:00	long	long	long	long	nil	nil	long	nil	nil	long	short	nil	nil	nil
27th Jul	Thu	15:00	long	long	long	long	nil	nil	long	nil	long	long	long	nil	nil	nil
28th Jul	Fri	14:30	long	long	long	long						long	long	nil	nil	nil
29th Jul	Sat	14:30	long	long	long	long	long	long	short	nil	nil	long	long	nil	nil	nil
30th Jul	Sun	10:30	long	long	long	long	nil	short	short	nil	nil	long	long	nil	nil	short
31st Jul	Mon	14:00	long	long	long	long	nil	short	nil	nil	nil	short	short	nil	nil	short
1st Aug	Tue	15:30	long	long	long	long	nil	nil	short	nil	nil	long	long	nil	nil	nil
2nd Aug	Wed	14:30	long	long	long	long	nil	nil	nil	nil	long	long	long	nil	nil	nil
3rd Aug	Thu	15:00	short	long	long	long	nil	short	long	nil	short	long	long	nil	short	long
4th Aug	Fri	15:00	nil	long	long	long	nil	nil	short	long	nil	long	long	nil	nil	long
5th Aug	Sat	15:30	long	long	long	long	nil	short	long	nil	nil	short	long	nil	nil	nil
6th Aug	Sun	10:30	long	long	long	long	nil	nil	short	nil	nil	short	short	nil	long	long
7th Aug	Mon	15:30	long	long	long	long	nil	short	long	nil	nil	short	short	nil	long	long
8th Aug	Tue	15:00	long	long	long	long	nil	nil	short	nil	nil	short	short	nil	nil	short
9th Aug	Wed	15:00	long	long	long	long	nil	nil	long	nil	nil	short	short	nil	nil	nil
10th Aug	Thu	15:30	long	long	long	long	short	long	long	nil	nil	short	long	nil	long	long
11th Aug	Fri	14:00	long	long	long	long	nil	long	short	nil	nil	nil	nil	nil	nil	long
12th Aug	Sat	11:30	long	long	long	long	nil	long	short	nil	nil	nil	short	nil	nil	long
13th Aug	Sun	10:30	long	long	long	long	nil	short	long	nil	nil	nil	short	nil	nil	short

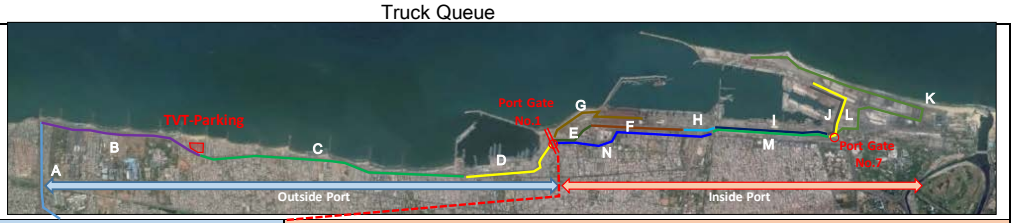
Truck Queue : nil, short (less than 30), long (30 or more),

Figure 3-12 Congestion Status inside the Port (11th Dispatch)

Heavy congestion was observed outside the port every day during the survey period.

On the other hand, congestion inside the port was not heavy compared to the previous dispatches. Even in J section (from PSA IN gate to the area near Port Gate No.7), congestion was not often observed. Congestion was sometimes observed on the periphery road toward Port Gate No.1 and it continued up to DPW OUT gate. This suggests that entry/exit procedures at Port Gate No.1 may have become inefficient.

Truck Queue



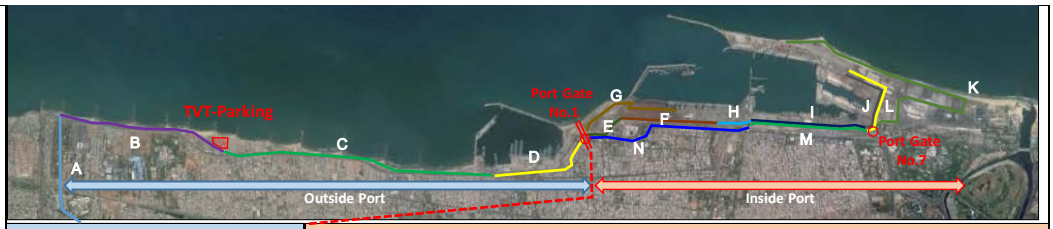
Location			Outside Port				Inside Port									
			A	B	C	D	E	F	G	H	I	J	K	L	M	N
Date	Week	Time	beyod Bharath Nagar Point	Bharath Nagar Point ~ TVT-Parking	TVT-Parking ~ Access Road Entrance	Access Road Entrance ~ **Port Gate 1**	Port Gate 1 ~ X-Ray Intersection	X-Ray Intersection ~ **DPW Entrance**	Port Gate 1 ~ **DPW North Gate** (without Cotainer)	DPW Entrance ~ DPW Exit	DPW Exit ~ Port Gate 7	Port Gate 7 ~ **PSA Entrance**	Port Gate 7 ~ **PSA Entrance** (without Cotainer)	PSA Exit ~ Port Gate 7	Port Gate 7 ~ DPW Exit	DPW Exit ~ Port Gate 1 (Exit)
11-Oct	Wed	11:00	long	long	long	long										
12-Oct	Thu	15:30	long	long	long	long										
13-Oct	Fri	16:30	long	long	long	long	nil	nil	nil	nil	nil	long	short	nil	nil	nil
14-Oct	Sat	11:00	long	long	long	long	nil	nil	nil	nil	long	long	long	nil	nil	nil
15-Oct	Sun	11:00	nil	short	long	short	nil	long	long	nil	short	long	long	nil	nil	nil
16-Oct	Mon	15:00	nil	nil	nil	short	nil	nil	nil	nil	nil	short	short	nil	nil	nil
17-Oct	Tue	15:00	nil	nil	nil	short	nil	short	long	nil	nil	short	short	nil	nil	nil
18-Oct	Wed	12:00	nil	nil	nil	nil	nil	long	long	nil	nil	short	short	nil	nil	nil
19-Oct	Thu	15:00	nil	nil	nil	nil	nil	long	long	nil	nil	long	short	nil	nil	nil
20-Oct	Fri	15:00	nil	nil	nil	nil	nil	nil	short	nil	nil	long	long	nil	nil	nil
21-Oct	Sat	15:00	nil	nil	nil	short	nil	nil	short	nil	nil	long	long	nil	nil	nil
22-Oct	Sun	11:00	nil	nil	nil	nil	nil	nil	long	nil	nil	long	long	nil	nil	nil
23-Oct	Mon	15:30	nil	nil	nil	long	nil	nil	long	nil	nil	nil	short	nil	nil	long
24-Oct	Tue	15:00	nil	long	long	long	short	nil	long	nil	nil	nil	short	nil	nil	short

Figure 3-13 Congestion Status inside the Port (12th Dispatch)

Queuing trailers going to PSA IN gate and East IN gate were observed several times; however these queue ware not queues which affected other places.

Regarding trailers toward DPW North IN gate, congestion was usually observed. Empty trailers have to turn left after passing Port Gate No.1 and take the coastal route while empty trailers from PSA terminal take the northern road of the former iron ore wharf after passing the intersection near the X-ray inspection center. These inconsistent routes toward DPW North IN gate create confusion in the traffic flow. In addition, as trailers required to be inspected at the X-ray inspection center pass this area, this area becomes the most congested area inside the port. To resolve this congestion, the traffic route toward DPA North IN gate has to be clear and a new X-ray inspection center for import containers is required at the proper place along the traffic flow of import containers.

Total of 77-days' survey result during the Phase II project is shown in the following figure.



Location	Outside Port				Inside Port									
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Congestion quene status	beyod Bharath Nagar Point	Bharath Nagar Point ~ TVT-Parking	TVT-Parking ~ Access Road Entrance	Access Road Entrance ~ **Port Gate 1**	Port Gate 1 ~ X-Ray Intersection	X-Ray Intersection ~ **DPW Entrance**	Port Gate 1 ~ **DPW North Gate** (without Cotainer)	DPW Entrance ~ DPW Exit	DPW Exit ~ Port Gate 7	Port Gate 7 ~ **PSA Entrance**	Port Gate 7 ~ **PSA Entrance** (without Cotainer)	PSA Exit ~ Port Gate 7	Port Gate 7 ~ DPW Exit	DPW Exit ~ Port Gate 1 (Exit)
nil	38	30	20	12	59	40	10	66	45	29	3	71	67	37
short	3	3	2	10	5	13	20	2	15	15	20	0	2	19
long	35	43	54	54	5	17	21	2	12	29	30	2	4	17
Unverified	1	1	1	1	8	7	26	7	5	4	24	4	4	4

(Note: Figures in each column represent the congestion level observed. Blue color in the graphs shows the frequency of the congestion level. Section G and K became operational from the 10th dispatch; therefore only limited number of survey days could be conducted.)

Figure 3-14 Congestion Level inside and outside the Port

This analysis was conducted to grasp the starting points of congestion which can be understood as the bottlenecks of the traffic flow inside and outside the port. In **Figure 3-14,** large figures in the "long" column (colored in red) are large may indicate bottlenecks.

The starting points of congestion were usually Port Gate No.1 (IN gate), DPW IN gate and Port Gate No.1 (OUT gate) during the Phase I project. During the Phase II project, congestion starting at DPW IN gate was seldom observed. Instead, congestion starting PSA IN gate was sometimes observed while Port Gate No.1 was still observed as the starting point of congestion. This may be because the handling volume at PSA terminal has increased. Newly installed gates dedicated for picking up import containers have become congestion points. (Section G and K)

3-5-3. Traffic Survey inside and outside the Port

(1) Stop lines by Traffic Police along roads outside the Port

The Team observed that Traffic Police stop container trailers for a certain period of time at fixed locations along roads outside the Port (refer to the figure below). It is thought the police stop trailers in order to avoid trailer queues in areas where there are many pedestrians. The Traffic Police allow trailers to proceed occasionally after confirming the congestion status along the road ahead by communicating with other police officers using wireless radio equipment. It has been sometimes observed that traffic of general vehicles is hindered by double parked trailers along the roads ahead State Highway 114 (SH114) during periods of heavy congestion.

Figure 3-15 Major Stop Lines along the Roads outside the Port

(2) Improvement of the access road and SH114

The removal of houses that has hindered the widening of SH114 at NTO Kuppam has been completed. The widening of the road and the introduction of a lane dedicated for container trailers (planned in the near future) are expected to alleviate the congestion along this section of SH 114.

The expansion and improvement works of the access road between Port Gate No.1 and SH114 are still suspended. The completion of the conversion work into a four-lane road in this section at early stage is expected as it is very difficult for trailers to pass each other at this area due to the narrow road.

The Team observed that trailers were sometimes unable to access the lane dedicated for trailers due to construction work of the pipeline during the 11th and the 12th dispatch.

Figure 3-16 Improvement of SH114 and Access Road

(3) Traffic Flow inside the Port

An exclusive traffic route for empty chassis to receive import container has been established both for DPW and PSA. The traffic flow for empty trailers is completely separated from the one for trailers that bring in containers. This measure is aimed at alleviating the congestion along the route by allowing empty chassis to wait along the separated route.

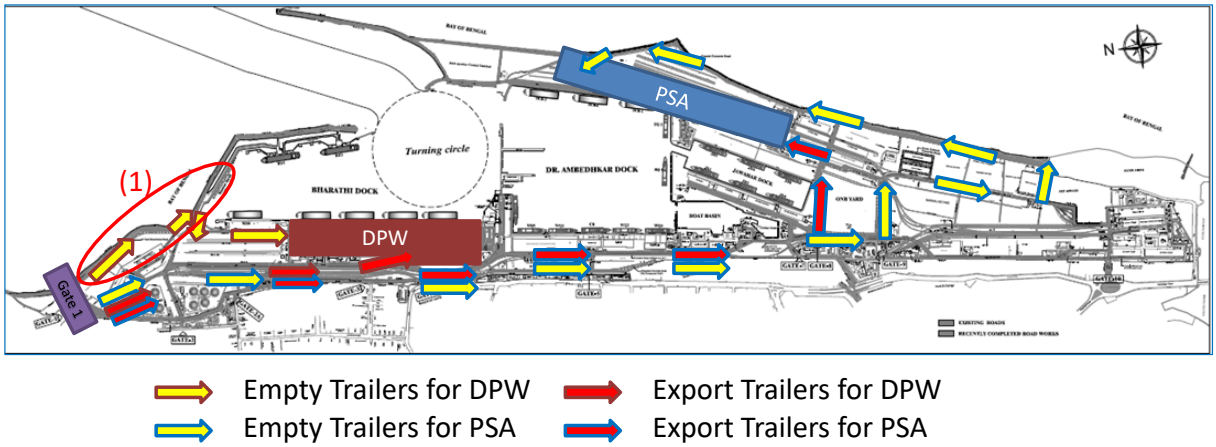


Figure 3-17 Separation of empty trailer flow from laden trailer

However, the Team sometimes observed that the empty trailer queue towards DPW North Gate

reached Port Gate No.1. It stopped the trailer reception at Port Gate No.1 and some empty trailers were forced to flow into the other trailers flow (Refer to (1) in the above Figure). This probably occurred because the capacity of queuing trailers on the access road is lower than the one for PSA.

As for the traffic status inside the Port, the Team often observed traffic congestion at the following points in addition to in front of the main terminal gates.

1) Intersection near the X-Ray inspection area

The Team has observed traffic congestion and even arguments around this area. It seems to be caused by the crossing of multiple trailer flows, such as the export container trailer flow for DPW/PSA, the import container trailer flow for X-Ray inspection area, and the empty trailer flow for DPW North Gate.

2) Outgoing trailer flow near Port Gate No.4

The Team has often observed traffic congestion between the canteen near Port Gate No.4 and the DPW Out Gate. In most cases, it is caused by a trailer which stops or parks at the center of the road around the canteen; traffic congestion is usually not observed beyond that area.

In addition to container trailers, tank trailers are sometimes responsible for congestion.

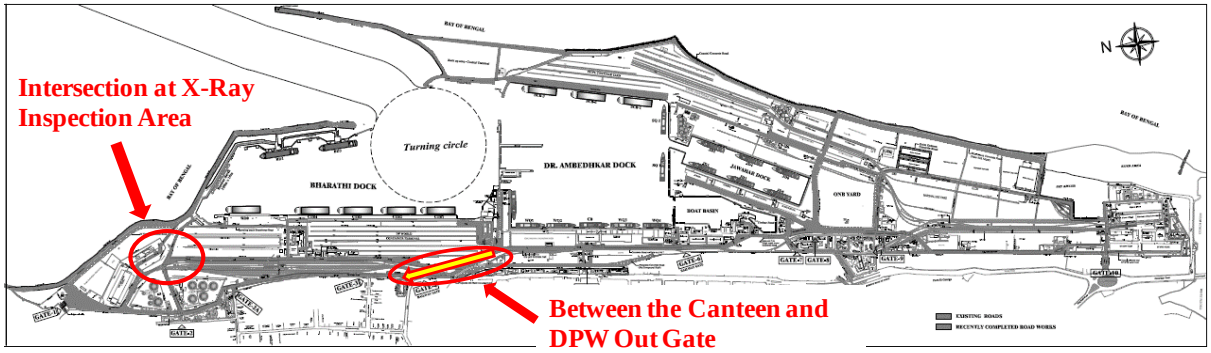


Figure 3-18 Major Congestion Points inside the Port

(4) Widening/improvement of the internal roads

Expansion works of the road at the sections of the west side of the Boat Basin and Timber Pond are underway. The current 3-lane road will be expanded to 4 lanes in this section. The entire section between the DPW OUT Gate and the area near Port Gate No.7 will be completed when this section is finished.

Road widening works for incoming trailers at the vicinity of CFS, which is known as the O-Yard, has been completed. However, since only a small section was widened, it will have a limited effect on the alleviation of congestion.

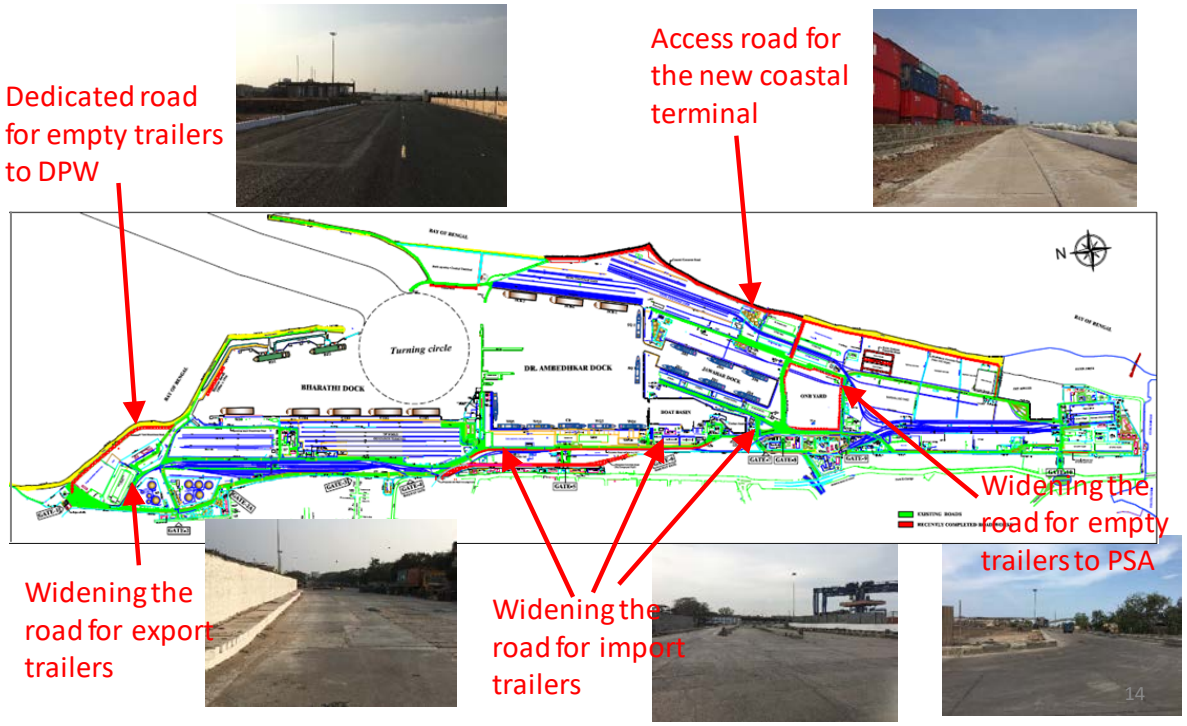


Figure 3-19 Widening / Improvement of the Internal Roads

(5) Realignment of the port premises

The port premises have become narrower due to the widening of the railway section outside between Gate 4 and Gate 6. The boundary fence of the harbor limit has been relocated toward the sea. Realignment work is also being conducted in the port.

(6) Redevelopment of the former Old Navy Barracks (ONB) area

ONB (Old Navy Barracks) and the surrounding areas have been cleared. This is the work to rearrange the land use of ONB and its surroundings. The area will be utilized as a multipurpose cargo handling area. The road on the south side of ONB has been expanded to 6 lanes and is already being used by empty chassis heading to PSA.

Furthermore, ChPT has started planting trees around the area as an environmental improvement measure. Their plan is to surround the entire area with a green belt consisting of trees and lawns.

Picture 3-3 Pavement Works and Planting at ONB Area

(7) Improvement of the DPW IN Gate

The Team prepared the TOR for the operation rule for trailer entry process at the terminal IN gate together with the proposal for changing the layout of the DPW IN Gate based on site surveys during the 8th dispatch. Though the Team observed no changes in the layout during the 9th dispatch, obvious changes were found during the 10th dispatch. The entrance to gate lanes was clearly segregated by concrete blocks which reduced the number of parked trailers at this area. The Team believes that this change makes working conditions safer for gate surveyors and should also increase the efficiency of gate procedures.

Picture 3-4 Improved DPW IN Gate

3-5-4. Following-up of Demo 1 to 4

(1) Demo 1: Simplification of gate procedures at Port gate No.1

1) Status of implementing Port entry / exit control system

A Port entry / exit control system similar to the bar code reading system of demonstration trial 1 has not been implemented. The RFID system has been introduced but it is not aimed at controlling trailers' port entry and exit but improving the gate efficiency for the CFS and terminals. The information collected by the RFID system at the Port Gate No.1 is only utilized as statistical data for ChPT senior officers.

On the other hand, ChPT plans to introduce the Port entry / exit control system using RFID technology, which will replace the paper-based Harbor Entry Permit (HEP). However, the public tender process has not yet started.

2) Operational status at Port Gate No.1

The Team found that the trailer entry procedure at Port Gate No.1 had been changed during 11th dispatch. A truck driver has to get off his truck, walk down to the reception desk, then walk back to his truck according to the current procedure, while he could proceed to the reception window in a gate lane without getting off his truck before. Moreover, the reception is conducted in serial order for each trailer while it was conducted in parallel for each lane before.

Furthermore, the number of lanes used for incoming trailers is always 2 now while it was changed depending on the queue outside the Port before.

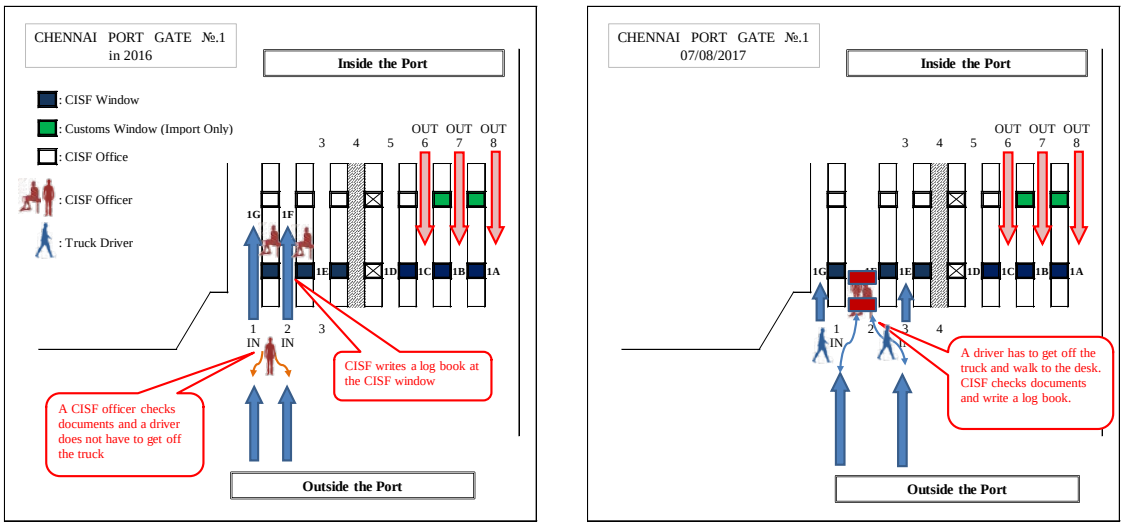


Figure 3-20 Changes in Port Entry Procedure of Trailers at Port Gate No.1

The Team also observed that the documentation checks are conducted in two rows regardless of the number of lanes deployed (usually 3 or 4) for outgoing trailers at Port Gate No.1. The Team sometimes observed that only one CISF officer was allocated for documentation checks for two rows of trailers although there were many trailers waiting. Traffic congestion starting from Port Gate No.1

was generated inside the Port in such cases.

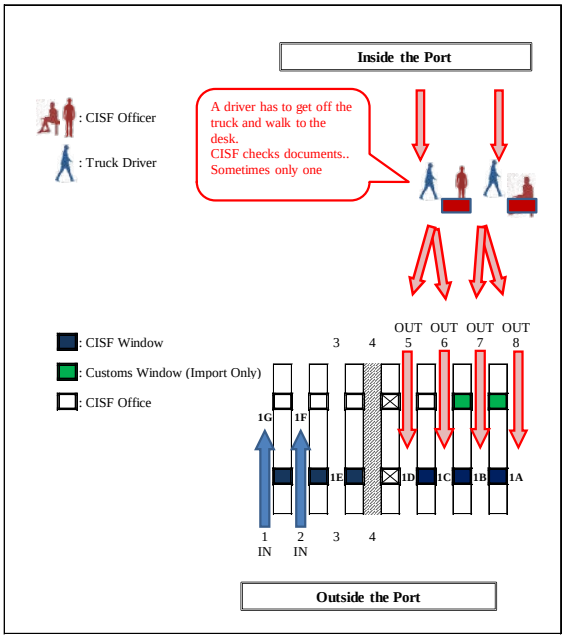


Figure 3-21 Procedure for Outgoing Trailers at Port Gate No.1

3) Survey on operation at Port Gate No.1

The Team conducted a survey on the time required for entry/exit procedures at Port Gate No.1 during the 12th dispatch following the changes in the reception procedure at Port Gate No.1 during the 11th dispatch. The survey was conducted over a two-day period and for 5 hours on each day.

The following table shows the transition of time for gate entry process at Port Gate No.1.

Table 3-4 Transition of Time for Gate Entry Process at Port Gate No.1

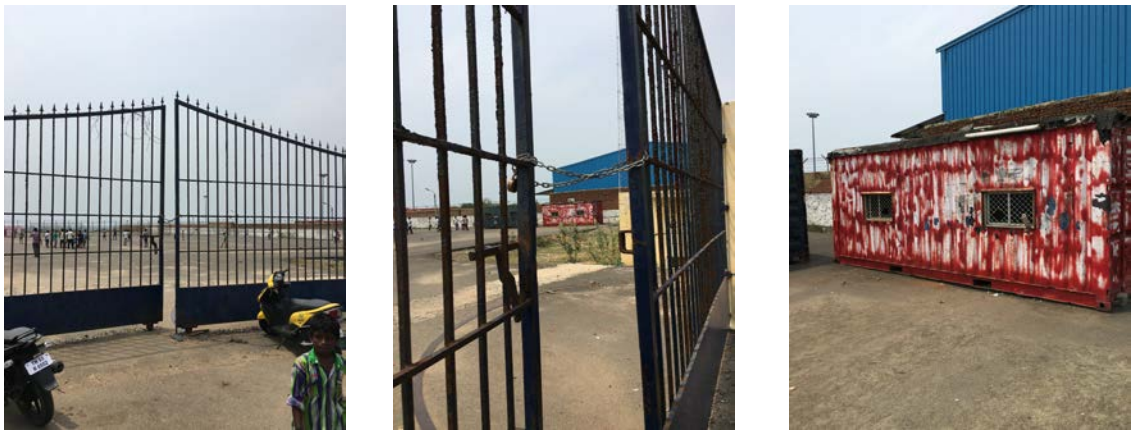
Time	At the 1st dispatch (June 2014)	During the trial (February 2015)	After the Trial (April 2015)	This dispatch (October 2017)
IN Gate (min)	**3.5**	**2.5**	**1.8**	**0.8**
Out Gate (min)	**5.5**	**2.0**	**2.3**	**2.0**

The gate entry process was much faster than before according to the table. However, the actual number of trailers going into the Port was less than 50 per hour for each lane on average, even though more than 70 trailers should be able to enter the Port in each lane per hour based on the average processing time. This is because the traffic flow of trailers is not as smooth as before because trailer drivers now are forced to stop and get off their truck in front of the gate for the reception procedure. A similar situation is observed in front of the DPW Main Gate.

On the other hand, the gate out process was not any faster than before. Moreover, it took more than 5 minutes for the whole process including the CISF check in front of the gate, which was not included in the previous survey. The processing time for exiting largely depends on the gate lane; lane 1A is the fastest because a Customs officer is stationed there.

(2) Demo 2: Utilization of TVT-Parking

The utilization of TVT-Parking was not effective for alleviating the congestion during the implementation of the demonstration trial (Demo2) and after that. The TVT-parking was not used as a parking lot although the issuance of HEP was still in operation. Agents or trailer drivers visit here to renew HEP.



Picture 3-5 HEP issuing place and locked gate at TVT-Parking

(3) Demo 3: Restriction of parking on internal roads

The Team counted the number of parked trailers on the roads. The traffic flow of trailers inside the Port seemed to be smoother due to the separation of traffic flow of empty trailers from laden ones and the decreasing handling volume at the DPW terminal. However, a large number of parked trailers are still observed.

1) On-street parking inside the Port

The following figure shows the areas (A to E) where large numbers of parked trailers were found.

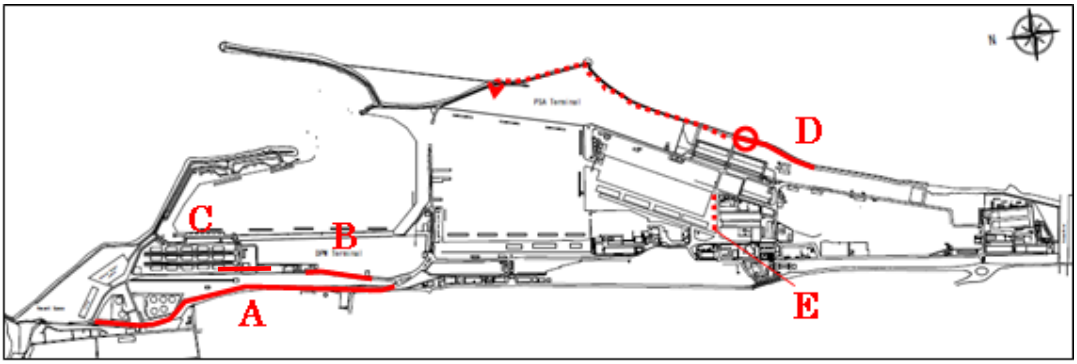


Figure 3-22 Main Areas inside the Port where many Trailers Park

A：DPW Out Gate－Port Gate No.1(Out)

This is the area where the largest number of trailers has parked since the congestion survey started. The Team often observed that many trailers were parked along both sides of the road in this area. Outgoing trailers often could not proceed due to double or triple parked trailers or due to the trailer ahead suddenly stopping.

Picture 3-6 Outgoing Trailer Flow towards Port Gate No.1 (A) and Parked Trailers besides DPW IN Gate (B)

B：DPW In Gate－ DPW Out Gate

During the latest dispatch, the Team often observed that many laden trailers were parked around this area, which had not been observed before. It is likely that drivers parked here while waiting for the CY to open to or while waiting for the documents to pick up an import container after delivering their containers (double transaction). These parked trailers interrupted the normal trailer flow around the area.

C：Traffic flow towards DPW North Gate

DPW has stopped accepting empty trailers for picking up import containers at the main IN gate; empty trailers must now use the north gate. This might increase the number of parked empty trailers in the area as drivers may want to wait for documents (Form13/DRF) to pick up import containers.

D：Traffic flow towards PSA North Gate

PSA has introduced the north gate dedicated to empty trailers for picking up import containers, the same as DPW. PSA permanently allocates control persons to align the trailer queue into one line at the point indicated by the red circle in the above figure. Many parked and waiting trailers were observed before the control point was introduced.

Picture 3-7 Parked Trailers along the route towards DPW North Gate (C), Waiting Trailers and Traffic Control Persons around the south side of PSA North Gate (D)

E：Traffic flow of laden trailers toward PSA (south side of JD)

In area E shown in **Figure 3-22**, it was observed that many trailers with export containers were waiting next to the queues for the PSA IN Gate. These trailers were waiting for orders to pick up import containers before proceeding to the PSA IN Gate for a double transaction. The double transaction allows a trailer to undergo reception procedures for both export container receiving and import container delivery at the same time. Those waiting trailers sometimes hindered the flow of the waiting queue for PSA.

2) Number of parked trailers along the main access road inside the Port

The Team continued to count the number of parked trailers along the main access roads after the demonstration trial and observed that many container trailers still parked there.

The following table shows the maximum and average number of parked trailers of the surveys to date.

Table 3-5 Number of Parked Trailers along major traffic flows inside the Port

Survey on Parked Trailers inside the Port		3rd Dispatch 9Feb-15Feb.15	4th Dispatch 15Apr-20Apr.15	5th Dispatch 9Jul-25Jul.15	6th Dispatch 3Oct-13Oct.15	7th Dispatch 29Jan-16Feb.16	8th Dispatch 22May-10Jun.16	9th Dispatch 13Feb-5Mar.17	10th Dispatch 24Apr-14May.17	11th Dispatch 24Jul-13Aug.17	12th Dispatch 11.Oct-31.Oct.17	AVE
From Port Gate 1 To X-Ray Intersection	Maximum	49	15	9	10	26	17	37	34	40	32	26.9
	Average	15	15	2	6	9	6	18	15	18	17	12.1
From X-Ray Intersection To DPW Entrance	Maximum	59	87	44	45	52	32	78	65	42	48	55.2
	Average	22	71	9	41	25	15	46	35	24	26	31.4
From DPW Exit To Port Gate 1	Maximum	165	95	101	249	176	125	170	117	110	97	140.5
	Average	89	90	57	119	102	82	110	78	65	78	87.0

- From Port Gate No.1 to the X-Ray Intersection

  On average 12.1 parked trailers were observed over the course of 10 surveys. Although the Team sometimes observed queues which reached up to DPW IN Gate in 2014, such queues have not been observed since 2015 (the survey period of the above table). The Team considers that this is a result of the various countermeasures including demonstration trial 3 conducted by stakeholders. However, the widening of the access road next to the CFS (O Yard) inside the Port has resulted in an increase in parked trailers though the trailer flow was greatly improved.

- From X-Ray Intersection to the DPW Entrance

  The Team has often observed many trailers parked around this area; a maximum of 56 trailers and an average of 32 trailers were observed parking here according to the surveys. During the 11th and the 12th dispatch, parked trailers showed a tendency to decrease due to the separation of trailers flow between export trailers and empty trailers, which used to be mixed before the North Gate was opened; a maximum of 43 trailers and an average of 24 trailers were observed parking here.

- From the DPW Exit to Port Gate No.1

  The Team has often observed that many parked trailers, particularly double or triple parked trailers, disrupt the trailer flow in this area. Furthermore, mixture of trailer flows (containers and tank lorries) has sometimes caused confusion and congestion.

  The Team conducted an interview survey on reasons for parked trailers inside the Port. According to the survey, the main reasons that drivers park their trailers inside the port are as follows.

- Drivers are waiting for a work order of import container delivery after the completion of export container receiving or waiting for instructions from their company.
- Drivers are taking a rest after completing their work before returning to the CFS or their company.
- Drivers are waiting for a new HEP from an agent as their current HEP has expired

Overall, a maximum of 141 trailers and an average of 87 trailers were observed parking inside the Port; countermeasures should be introduced to reduce these numbers.

3) Number of parked trailers in the waiting space inside the Port

The following tables show the results of the survey of number trailers waiting in the waiting space inside the Port. The usage of the waiting space has decreased. The Team considers that trailer drivers try to park along an access road towards a gate in order to proceed to the gate at the soonest possible time.

Table 3-6 Number of Parked Trailers in the waiting space inside the Port

Survey on Waited Trailers at Waiting-Space		5th Dispatch 9Jul-25Jul.15	6th Dispatch 3Oct-13Oct.15	7th Dispatch 29Jan-16Feb.16	8th Dispatch 22May-10Jun.16	9th Dispatch 13Feb-5Mar.17	10th Dispatch 24Apr-14May.17	11th Dispatch 24Jul-13Aug.17	12th Dispatch 11.Oct-31.Oct.17	AVE
Near the Port Gate 1	Maximum	34	38	8	6	29	24	24	33	24.5
	Average	16	21	4	2	10	9	9	17	11.0
Near the X-Ray Intersection	Maximum	81	91	53	53	60	43	25	66	59.0
	Average	42	57	35	39	41	23	20	50	38.4
Old iron ore yard	Maximum	25	27	28	14	18	8	0	4	15.5
	Average	11	18	12	6	5	2	0	0	6.8
PSA Terminal South side	Maximum	0	0	0	0	121	0	0	0	15.1
	Average	0	0	0	0	34	0	0	0	4.3

- Near Port Gate No.1

The number of trailers using waiting spaces in this area has decreased. The Team considers that this is mainly due to separating the empty trailer flow from the laden one and introducing the new operation rule in which trailer entries from Port Gate No.1 are restricted in case of traffic congestion inside the Port.

- Near the X-Ray Intersection

Waiting spaces in this area have been utilized by relatively many trailers. However, it has been used for purposes other than initially expected as some trailers stay in the area for a few days.

The waiting space here is not convenient because many train tracks still remain (the area was formerly a railway yard) and there is only one entrance/exit which is connected to the X-Ray intersection. The waiting space should have a separate entrance and exit to improve the traffic flow; for example, the entrance could be set around the X-Ray intersection and the exit near the DPW power station.

(4) Demo 4: Allocation of traffic control persons at intersections together with introduction of traffic flow regulation

The Team examined the status of traffic regulations at major intersections inside the Port.

1) Intersection at the X-Ray Inspection Center

Traffic congestion has rarely observed since the DPW North gate was introduced. However, the Team sometimes observed that the trailer flow completely stops due to the mixture of an export trailer flow, an empty trailer flow (only when the normal access route to DPW North gate overflows), and the import trailer flow towards the X-Ray Inspection area.

2) Intersection outside DPW OUT gate

Trailers parked inside the intersection could not be observed. The Team believes trailer drivers have a greater awareness of the no parking rule. However, the instructions by traffic control persons are still required because it was observed that drivers disregarded the rule once congestion occurred.

Furthermore, traffic control persons were allocated around the intersection near Port Gate No.7 whenever the traffic congestion from PSA IN Gate reached Port Gate No.7.

Picture 3-8 Traffic Control Persons allocated around Port Gate No.7

3-6. Lead Time Analysis

The lead time from CFSs, CWC and factories (designated factory as ACP) to Port Gate No.1 is one of the indicators for evaluating the effect of congestion alleviation measures. On the other hand, shortening the lead time brings benefits to port users, specifically to transport business companies. The Team has conducted the lead time survey 12 times to date. The table below shows the results of the lead time surveys and the number of queuing trailers on the survey date.

Table 3-7 Lead Time and the Number of Queuing Trailers

Lead Time	Phase I of the Project							Phase II of the Project				
	2nd Dispatch			7th Dispatch		8th Dispatch		9th Dispatch			11th Dispatch	
	3-Oct-14	18-Oct-14	19-Oct-14	12-Feb-16	13-Feb-16	1-Jun-16	2-Jun-16	28-Feb-17	2-Mar-17	4-Mar-17	2-Aug-17	4-Aug-17
Average	28:29hrs	44:45hrs	36:54hrs	17:43hrs	19:43hrs	7:22hrs	14:55hrs	11:16hrs	21:56hrs	19:38hrs	22:20hrs	12:40hrs
Number of Queuing Trailers outside the port	595	803	689	874	785	75	497	575	566	494	711	234
Number of Survey Trailers	155	96	104	327	398	351	129	200	200	200	400	312

The figure below shows the trend of the lead time by survey date as graphs.

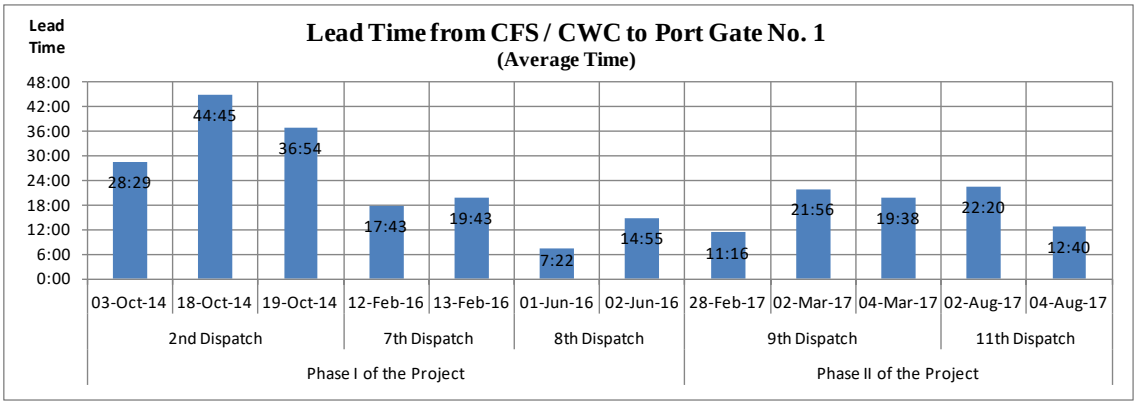
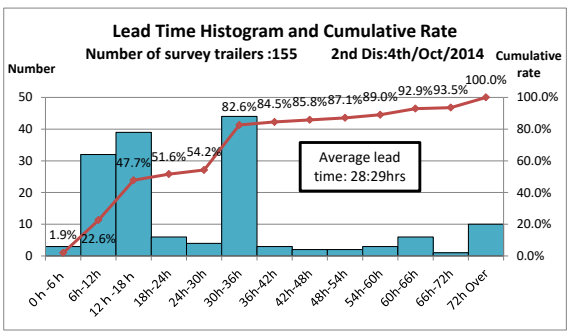
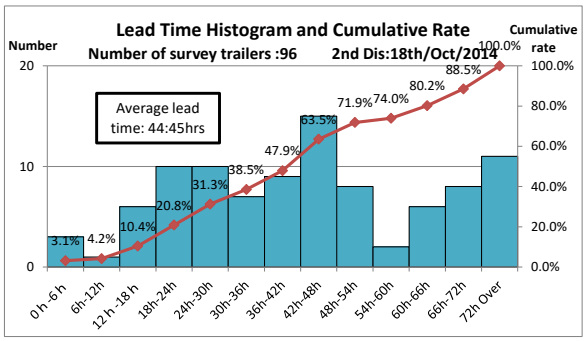


Figure 3-23 Trend of Lead Time

Though the lead time fluctuates by survey date, lead times of around 40 hours which were recorded at the initial stage of the Phase I project have not occurred in recent days. The lead time has steadily been decreased.

Distribution of the lead time and its cumulative rate of arrival at Port Gate No.1 by survey date are shown in the following figures. Cumulative rate of arrival means the rate of the number of trailers which arrived at Port Gate No.1within a certain time of the total survey number of trailers.





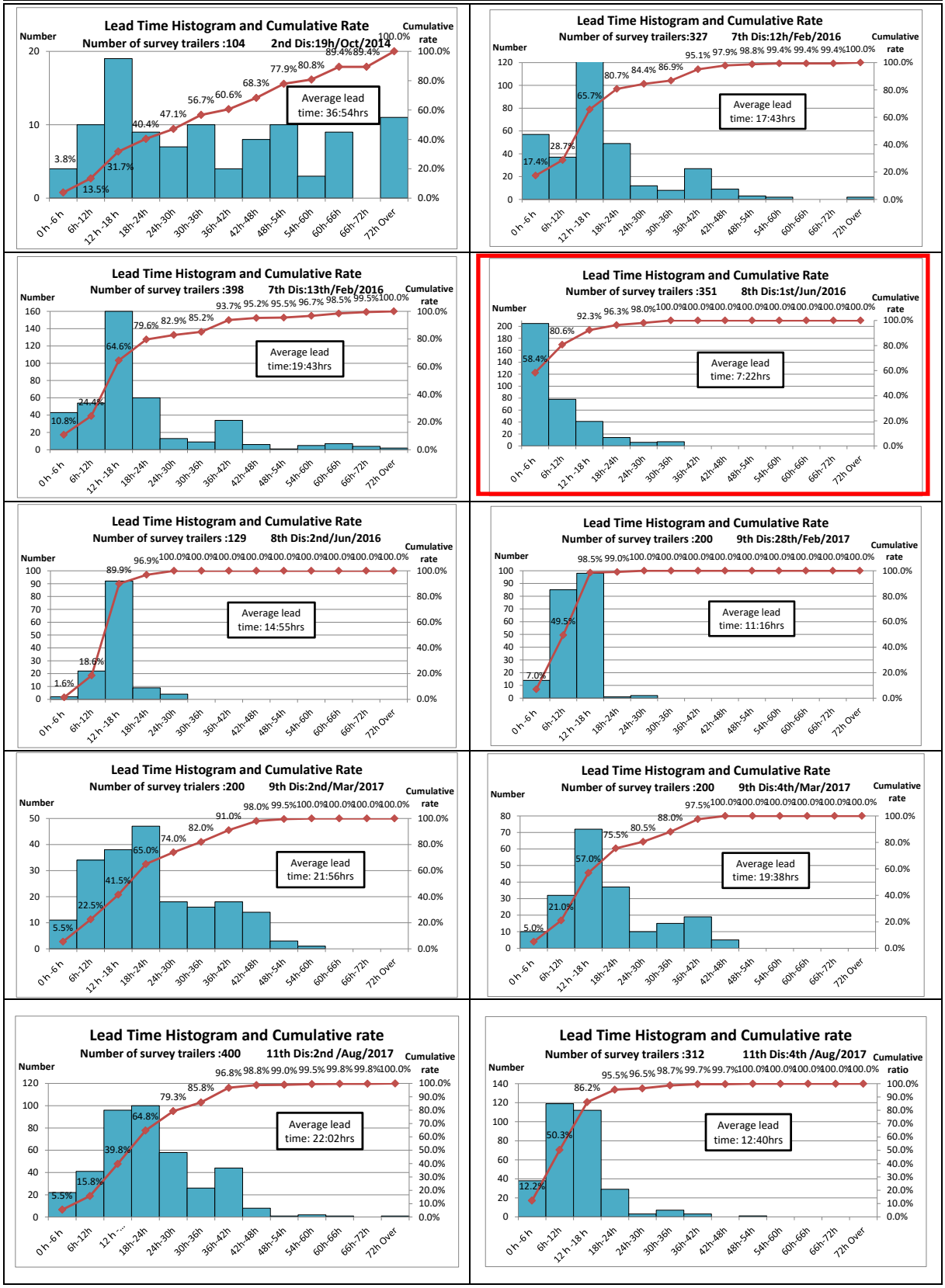


Figure 3-24 Cumulative Rate of Arrival at Port Gate No.1

In the above figures, the bar graphs show the number of trailers which arrived at Port gate No.1 by time slot while broken line shows the cumulative rate of those trailers. For example, in case of the

second figure on the right from the bottom 72 trailers arrived at Port Gate No.1 within a time slot of 12 hours to 18 hours and the cumulative rate of the total number of trailers which arrived by the time slot is 57.0 % of the total surveyed number of trailers.

The third figure on the right from the top (column in red) shows an ideal arrival distribution. Survey date of this figure is 1st June, 2016 of the 8th dispatch. Continuous efforts should be made to realize this arrival distribution.

The following table shows a comparison of the lead time between the 9th dispatch and the 11th dispatch.

Table 3-8 Lead Time Comparison between the 9th and 11th Dispatch

Comparison of lead time survey of 9th Dis and 11th Dis	9th Dispatch			11th Dispatch	
	28-Feb-17	2-Mar-17	4-Mar-17	2-Aug-17	4-Aug-17
Average Lead Time	11:16hrs	21:56hrs	19:38hrs	22:20hrs	12:40hrs
Number of Queuing Trailers outside the port	575	566	494	711	234
Number of Survey Trailers	200	200	200	400	312

The lead time on the survey date of 2nd March in the 9th dispatch was 21:56 hours against which the maximum number of queuing trailers was 566, while the lead time on the survey conducted on 2nd August in the 11th dispatch was 22:20 hours which is a similar level to that of the 9th dispatch (even though the number of queuing trailers was much larger). This means that the lead time seems to have substantially improved.

However, as congestion became heavier again during the 11th dispatch, continuous efforts are needed to reduce the number of queuing trailers even for the sake of shortening the lead time.

3-7. Traffic Flow Analysis inside the Port

The Team examined the trailer flow inside the Port and identified current issues. The Team also studied the causes of the issues and proposed countermeasures.

(1) North side of Chennai Port

The following issues are identified in this area.

1) Multiple trailer flows are generated towards the X-Ray inspection area including one which crosses another trailer flow at the intersection near the inspection area.
2) The trailer flow after X-Ray inspection is not clear.
3) A few trailers parked for a long time around the entrance of the inspection area.
4) Two empty trailer flows towards DPW merge.
5) One of the empty trailer flows towards DPW has to cross another trailer flow at the intersection

near the X-Ray inspection area.

The above issues 1) and 2) are caused by import trailers headed for X-Ray inspection. The problem is that the X-Ray Inspection Center is located along the export trailers flow instead of the import trailer flow. Issues 3) and 4) are caused by empty trailers coming from PSA and going to the DPW empty gate.

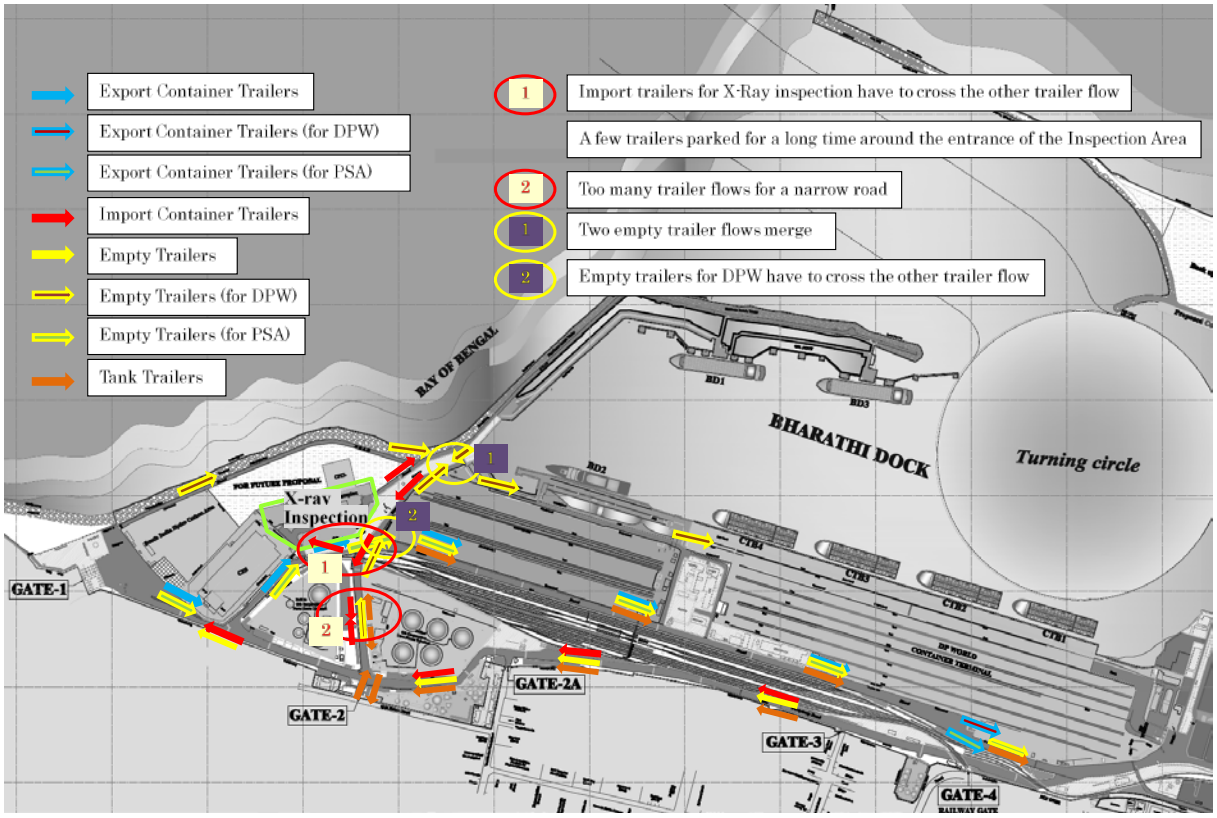


Figure 3-25 Current Trailer Flow (North side of Chennai port)

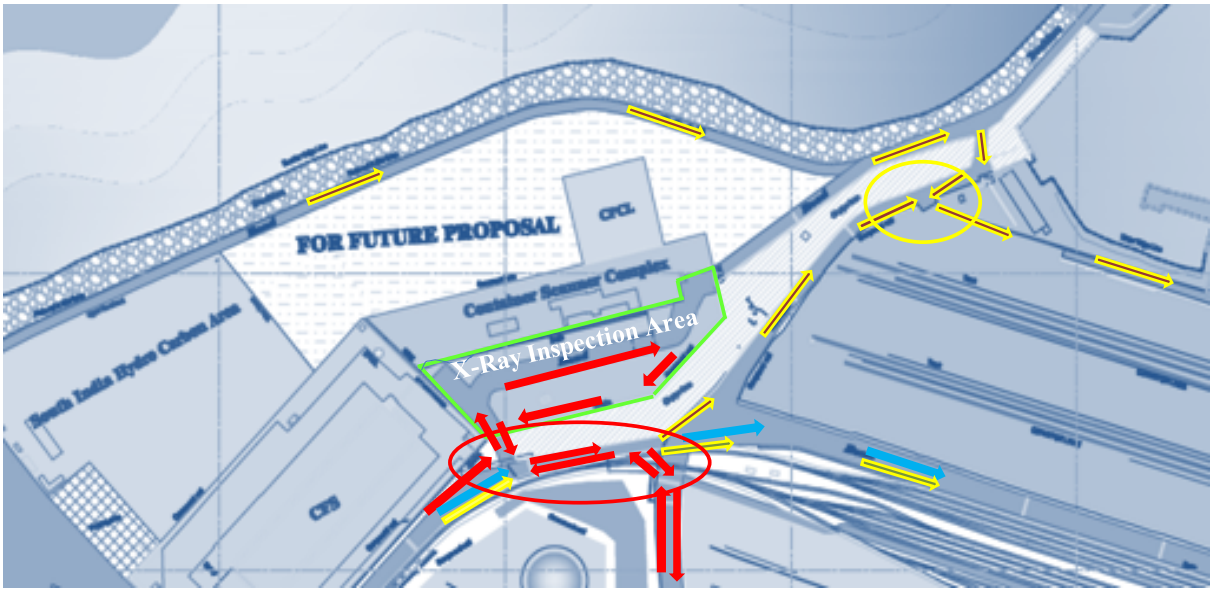


Figure 3-26 Current Trailer Flow (near X-Ray Inspection Area)

To overcome the issues described above, the Team proposed the following measures.

1) A new X-Ray Inspection Center is to be established for import containers along the import trailer flow. The existing X-Ray Inspection Center is to be used for export containers only or as a backup facility.

2) Empty trailer flow to DPW is to be unified so that the empty trailers coming from PSA join the flow at Port Gate No.1. The use of any short-cut route has to be strictly prohibited.

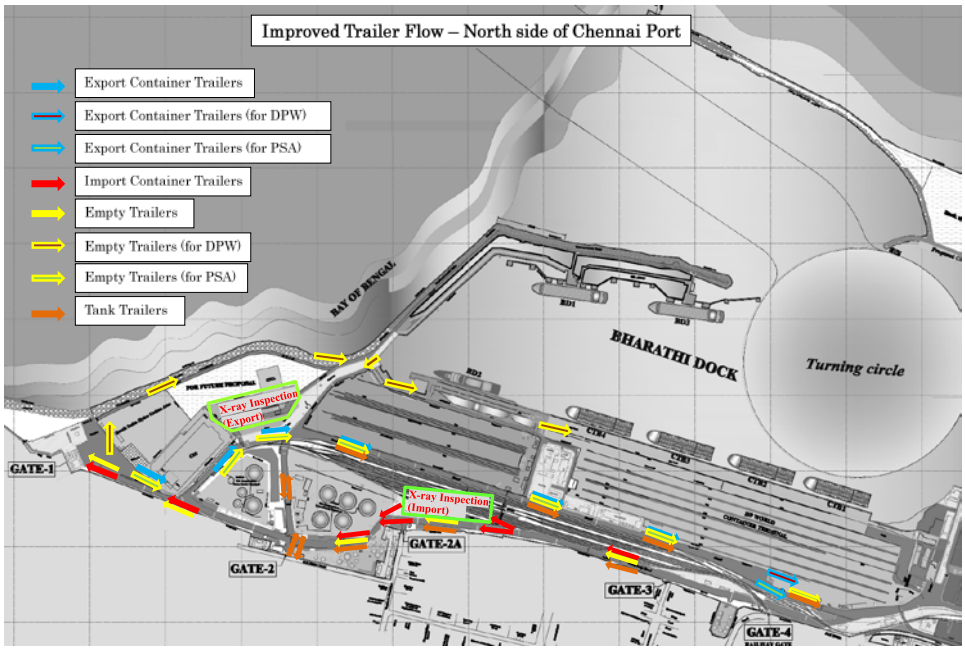


Figure 3-27 Improved Trailer Flow (North side of Chennai port)

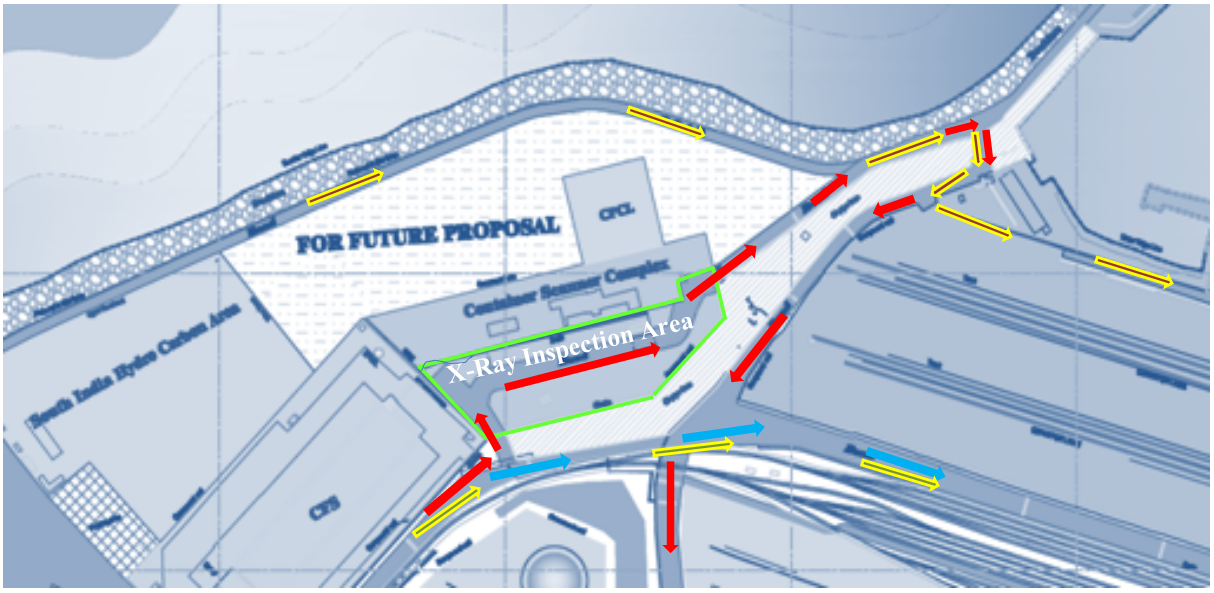


Figure 3-28 Tentative Improvement of Trailer Flow (near X-Ray Inspection Area)

(2) Central area of Chennai Port

In the central area of the port, the Team noticed that there are many types of trailer flows mixed on a narrow road. The Team has proposed a priority project on infrastructure, realignment/development of internal roads be implemented to address this issue.

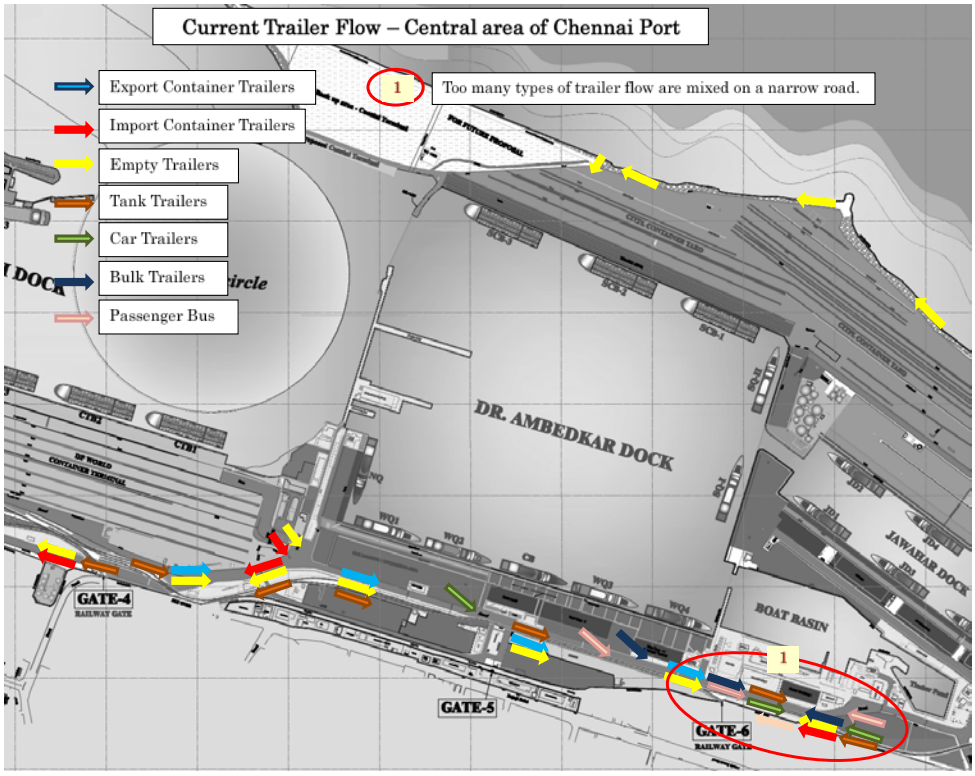


Figure 3-29 Current Trailer Flow (Central area of Chennai port)

(3) South side of Chennai Port

On the south side of Chennai Port, the trailer flow towards PSA has been greatly improved by the introduction of the new empty gate northeast of the terminal and by the separation of the empty trailer flow from the laden trailer flow by using the access road developed for the coastal terminal. Congestion around PSA has also been eased due to the increase of storage capacity of empty trailers towards PSA along the road.

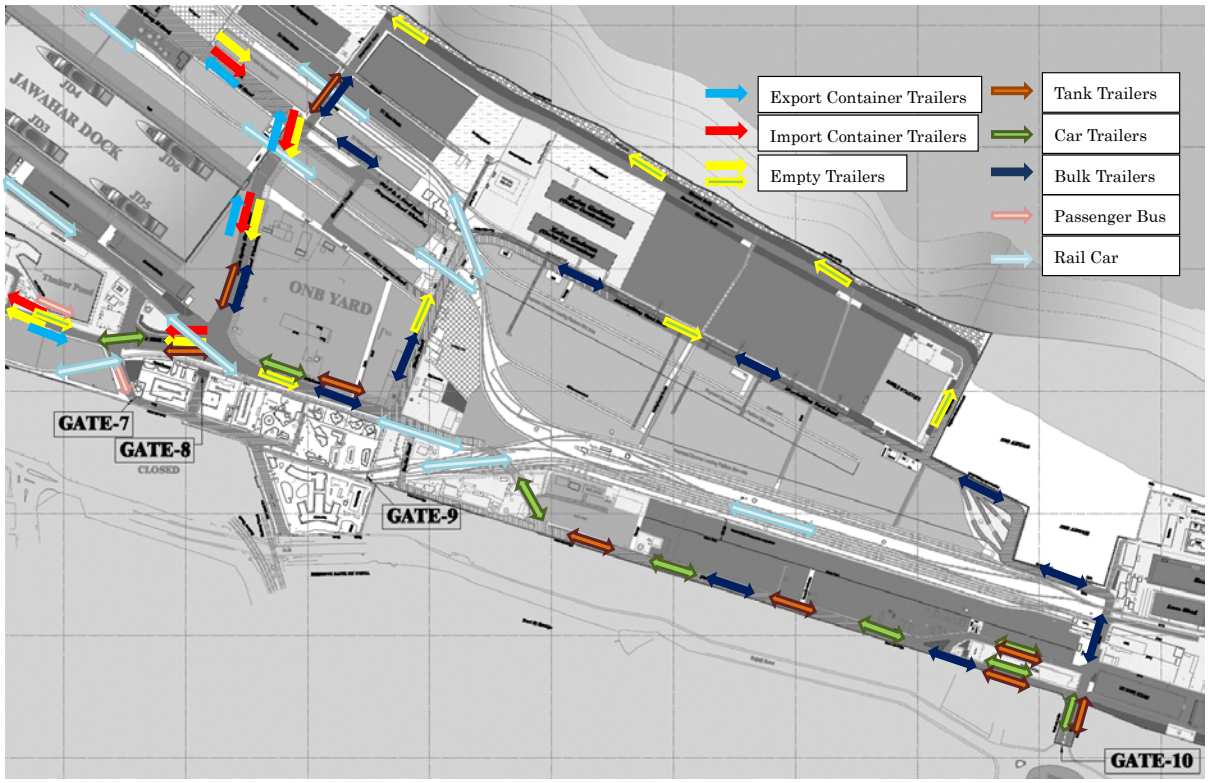


Figure 3-30 Current Trailer Flow (South side of Chennai port)

(4) Proposal on establishing a new Waiting Area for both container terminals

The Team proposed that a new Waiting Area be established for empty trailers near PSA terminal and that the trailer flow be changed accordingly after examining the trailer flow around the south side of Chennai Port during the 10th dispatch.

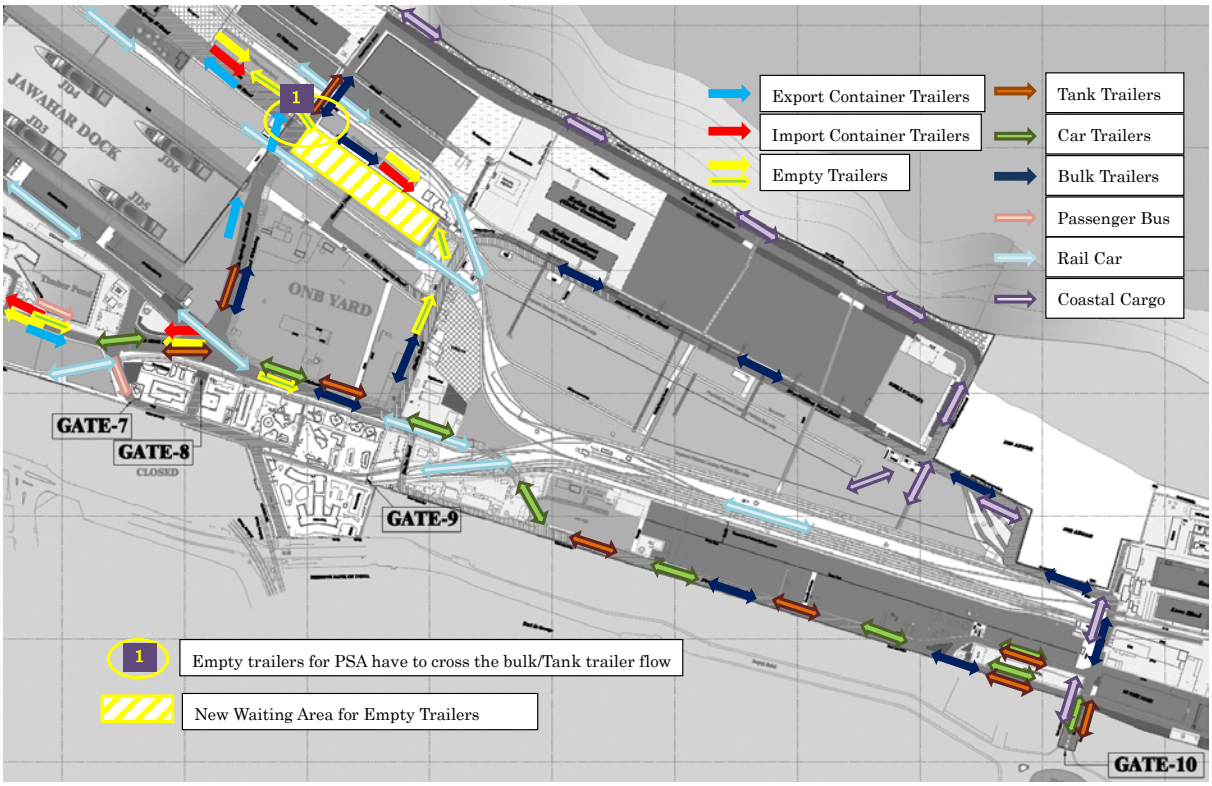


Figure 3-31 Proposal on Introduction of New Waiting Area for Empty Trailers

Furthermore, the Team examined the need to establish new Waiting Areas for both empty and laden trailers near the container terminal gates during the11th and the12th dispatch. The Team considers that such Waiting Areas would alleviate the traffic congestion outside the Port as well as solve several issues regarding the traffic flow inside the Port. This kind of Waiting Area has been introduced in JNPT (GTI terminal), Kattupalli Port, Yokohama Port in Japan, etc. Kamarajar Port is also planning to introduce a similar Waiting Area in the Port. The Waiting Area in Kattupalli Port is located just in front of the terminal gate and all the trailers are required to go through there before proceeding to the gate. The Waiting Area currently has a capacity of 80 to 90 trailers and the Port is planning to increase capacity up to about 300 trailers in line with the expected increase in the container handling volume.

Picture 3-9 Waiting Area near the Terminal Gate and Parking Lot in Kattupalli Port

1) Purpose of introducing Waiting Areas inside the Port

The Team has proposed the introduction of Waiting Areas inside the Port in order to alleviate the traffic congestion outside the port as well as secure road safety inside the port (including regular vehicles as well). Waiting areas will also help eliminate street parking inside the Port and trailers waiting for orders around the terminal gates.

2) Proposed location and basic function

The figure below shows the proposed Waiting Areas for DPW and PSA terminals.

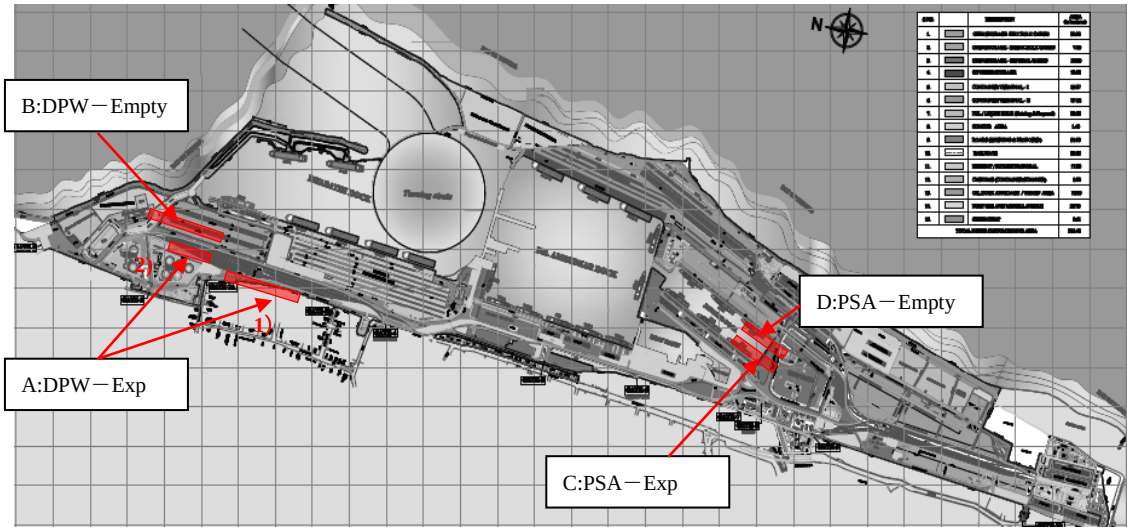


Figure 3-32 Overview of Proposed Waiting Area inside the Port

Function of each waiting area is; A: for trailers carrying-in export containers to DPA terminal (two options: A1 and A2), B: for empty trailers picking-up import containers from DPA terminal, C: for trailers carrying-in export containers to PSA terminal and D: for empty trailers picking-up import containers from PSA terminal. Each waiting area has a capacity of about 100 trailers.

Basic lane configuration is shown in the table and is referred to the description in the yellow frame in the figures below for details.

Table 3-9 Lane Configuration in the Waiting Area

Type of Trailers	Usage	Lane width	# of passing lanes	Capacity (# of trailers)
Laden (Export)	For trailers ready for gate reception	4m	0	40
	For trailers waiting for the documents or CY open date	4m	1	40
	Over dimension cargo	6m		20
Empty (Import)	For trailers ready for gate reception	4m	0	40
	For trailers waiting for the documents or CY open date	4m	1	60

3) Operation rules

In case of a waiting area for export containers to DPA terminal, operation rules are as follows.

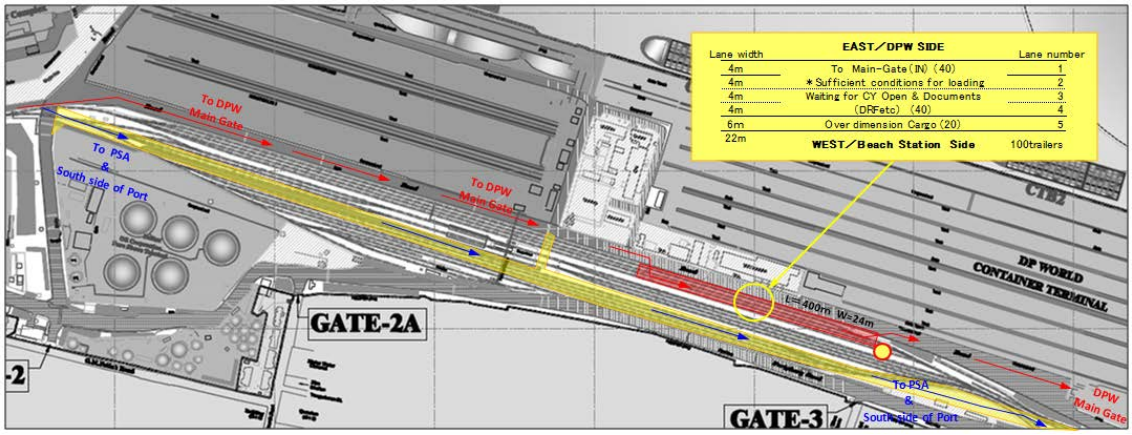


Figure 3-33 Proposed Waiting Area for DPW Export (A 1)

a) Introduction of waiting lanes

- This waiting area is established under the condition that a new road (shown in yellow in **Figure 3-33**) is developed.
- Four (4) lanes for ordinary containers (4 m in width and 400 m in length), one (1) lane for out-of-gate containers (6 m in width and 400 m in length) and one (1) passing lane are introduced in the red colored area shown in **Figure 3-33**.
- A white line is painted in-between lanes.
- No.5 lane is for the overtaking of trailers and is marked with white diagonal lines.
- A yellow line is painted in-between No.5 lane and No.6 lane to indicate that No.6 lane is for out-of-gate containers.
- Barriers of 1 m in height and 1.5 m in width will be installed to control entrance/exit flow of trailers.

b) Operation rules for lanes

1. All trailers carrying export containers to DPW terminal have to enter the waiting area and then go to DPW in-gate.
2. Each trailer must enter the proper lane which depends on the status of a trailer such as whether the driver possesses the proper documents such as Form 13 and Delivery Request form (DFR).
3. Operation rules for lanes are indicated in the table below.

Table 3-10 Operation Rules for Lanes

Lane No.	Operation Rules for Lanes
No.1Lane and No.2 Lane	・ Lanes for trailers with proper documents. ・ Trailers first proceed to No.1 lane. When No.1 lane becomes fully-occupied, trailers proceed to No.2 lane.
No.3 Lane and	・ Lanes for trailers without proper documents.

No.4 Lane	・ Trailers first proceed to No.3 lane. When No.3 lane becomes fully-occupied, trailers proceed to No.4 lane. ・ Trailers waiting in No.3 lane and No.4 lane proceed using No.2 lane or No.5 lane as soon as their documentation etc. has been completed.
No.5 Lane	・ Lane for overtaking of trailers after confirmation of status.
No.6 Lane	・ Lane for out-of-gate containers to wait up to the open-cut day of the terminal yard.

c) Allocation of traffic control persons at the Waiting Areas

- ・A traffic control person shall be allocated at the entrance and exit of each waiting area.
- ・The traffic control persons shall instruct trailer drivers and control trailer's movement such as entry, waiting and exit in accordance with the operation rules of lanes and the operation rules of the waiting area.
- ・A traffic control person allocated at the entrance of the waiting area shall control trailer flow in accordance with the following operation rules.
  1. To confirm the status of a trailer and to instruct a driver to enter the proper lane.
  2. In case of No.1 and No.2 lane, a driver is instructed to first go to No.1 lane and a barrier is placed at the entrance of No.2 lane.
  3. When No.1 lane becomes fully-occupied, the barrier is removed and drivers are instructed to go to No.2 lane.
  4. To repeat the procedures above.
  5. To report the vehicle number of the last trailer in the lane to a traffic control person at the exit.
  6. Operation of No.3 and No.4 lane follows the same procedure as No.1 and No.2 lane.
- ・A traffic person allocated at the exit of the waiting area shall control the trailer flow in accordance with the following operation rules.
  1. To instruct drivers to proceed to DPW in-gate after confirming that the queue in front of DPA in-gate is moving forward.
  2. To confirm the status of a trailer, such as whether the driver possesses the proper documents.
- ・Traffic control persons should be capable of determining whether documents are proper or not. (Gate surveyors are preferable.)

Operation rules in the waiting areas are attached in **Appendix 9**.

4) New access route to waiting areas for PSA terminal

In case of waiting areas for PSA terminal, a new access route for trailers has to be arranged in order to avoid crossing with bulk trucks going/coming to/from Jawahar Dock. The new access route is as follows: all trailers go to the end of Old Navy Barrack (ONB) area and turn left along the Radio Road and then proceed to the waiting areas.

Figure 3-34 Required Change of Trailer Flow due to Introduction of Waiting Space

5) Role Demarcation among Organizations Concerned

Organization	Roles and Functions
Chennai Port Trust	・Introduction of Waiting Areas
	・Notification of Operation Rules for Waiting Area
	・Supervision of Utilization and Modification of Operation Rules if needed
Container Terminal Operator	・Allocation of Traffic Control Persons
Trailer Driver	・Compliance with Operation Rules for Waiting Area

3-8. Demonstration Trial of Web Portal System

The Team planned a demonstration trial to publish the trailer flow information collected by the RFID system to stakeholders during the 9th dispatch after finding that an inquiry function of such information is provided for the senior officers of ChPT. After learning during the 10th dispatch that NACFS had set up the inquiry function, the Team asked NACFS for their cooperation in conducting the demonstration trial and requested the vendor of the RFID system to provide the transaction data of container trailers collected by the RFID system. The Team then developed the software to calculate the data and output an hourly transaction summary and a daily lead time of incoming trailers in a form to

be published on ChPT's Homepage. The Team obtained permission for conducting the demonstration trial during the 11th dispatch. After the ChPT EDP section made the necessary changes to the Homepage, the demonstration trial finally started from July 27th, 2017.

The demonstration trial is now ongoing up to January 2018 and the Homepage is updated every week according to the procedure below.

1) The vendor of the RFID system sends the transaction data of container trailers to the Team once a week by E-mail.

2) The Team generates the information to be published on the Homepage using the software developed for this purpose and sends it to ChPT EDP section via E-mail.

3) On receiving the E-mail from the Team, an officer of ChPT EDP section updates the Homepage based on the data prepared by the Team.

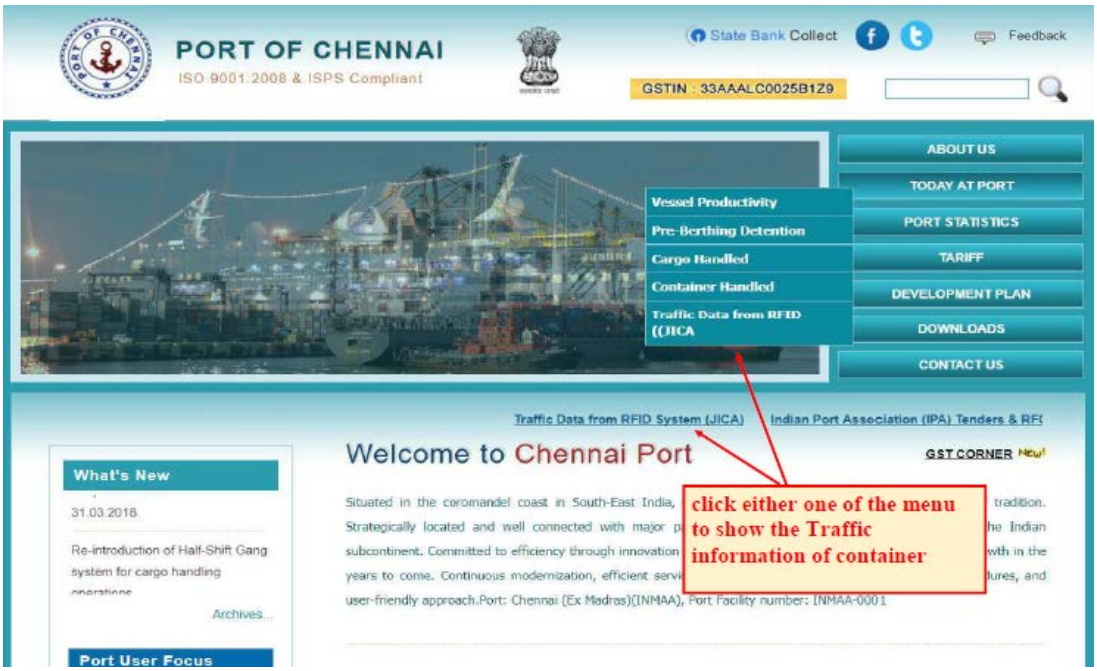


Figure 3-35 Update of ChPT Homepage

Weekly Average of Lead Time : **08:33** from CFS to Port Gate
03:06 from Port Gate to Terminals

Weekly Average of Transaction **1,353** Trailers enter from Port Gate / day
1,287 Trailers exit from Port Gate / day

LeadTime among CFS/Port Gate/Terminals

Date	Outside Port	Inside Port		
	CFS to ZeroGate	ZeroGate to CCTL	ZeroGate to CITPL	ZeroGate to Terminal
05/11/2017 (Sun)	01:40	00:14	00:20	00:20
06/11/2017 (Mon)	04:29	02:17	01:55	02:01
07/11/2017 (Tue)	09:36	02:05	02:31	02:20
08/11/2017 (Wed)	11:03	02:25	02:56	02:43
09/11/2017 (Thu)	09:45	03:52	05:10	04:36
10/11/2017 (Fri)	08:22	02:24	04:18	03:19
11/11/2017 (Sat)	08:04	02:13	03:15	02:39
12/11/2017 (Sun)	06:25	03:33	04:03	03:53

Distribution of LeadTime from CFS to Port Gate

Date	LeadTime Range in Hours							
	0- 6	6-12	12-18	18-24	24-30	30-36	36-42	42-48
05/11/2017 (Sun)	100%	0%	0%	0%	0%	0%	0%	0%
06/11/2017 (Mon)	73%	22%	3%	1%	0%	0%	0%	0%
07/11/2017 (Tue)	35%	34%	19%	8%	2%	1%	0%	0%
08/11/2017 (Wed)	31%	33%	20%	10%	3%	2%	2%	0%
09/11/2017 (Thu)	47%	24%	13%	8%	3%	3%	2%	1%
10/11/2017 (Fri)	54%	23%	12%	4%	3%	1%	1%	2%
11/11/2017 (Sat)	61%	17%	8%	6%	2%	3%	2%	1%
12/11/2017 (Sun)	72%	11%	6%	3%	3%	2%	2%	1%

Distribution of LeadTime from Port Gate to CY

Date	Terminal	LeadTime Range in Hours							
		0- 3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
05/11/2017 (Sun)	CCTL	100%	0%	0%	0%	0%	0%	0%	0%
	CITPL	100%	0%	0%	0%	0%	0%	0%	0%
06/11/2017 (Mon)	CCTL	77%	8%	6%	7%	1%	0%	1%	0%
	CITPL	83%	10%	4%	1%	1%	1%	0%	0%
07/11/2017 (Tue)	CCTL	83%	8%	3%	2%	3%	1%	0%	0%
	CITPL	82%	9%	2%	2%	3%	2%	0%	0%
08/11/2017 (Wed)	CCTL	76%	10%	7%	4%	1%	1%	1%	1%
	CITPL	68%	21%	3%	3%	2%	2%	1%	0%
09/11/2017 (Thu)	CCTL	70%	7%	8%	3%	6%	3%	2%	2%
	CITPL	40%	21%	23%	6%	4%	3%	2%	1%
10/11/2017 (Fri)	CCTL	82%	13%	3%	1%	1%	1%	0%	0%
	CITPL	36%	45%	9%	4%	3%	2%	1%	0%
11/11/2017 (Sat)	CCTL	74%	14%	5%	4%	2%	0%	0%	1%
	CITPL	63%	20%	6%	5%	4%	1%	1%	1%
12/11/2017 (Sun)	CCTL	73%	5%	5%	3%	5%	5%	2%	2%
	CITPL	59%	10%	21%	4%	2%	2%	3%	0%

Summary for 07/11/2017 (Tue)

Time	CFS	ZeroGate	CCTL	CITPL	Terminal
6:00	61	62	26	15	41
7:00	88	78	22	32	54
8:00	77	75	20	31	51
9:00	89	106	23	28	51
10:00	104	149	26	36	62
11:00	64	103	29	33	62
12:00	64	58	16	30	46
13:00	65	68	22	25	47
14:00	104	68	27	9	36
15:00	105	89	29	17	46
16:00	115	105	32	33	65
17:00	139	87	29	36	65
18:00	119	68	28	41	69
19:00	133	68	37	40	77
20:00	154	77	7	32	39
21:00	120	66	8	23	31
22:00	148	56	16	15	31
23:00	143	64	28	23	51
0:00	103	32	31	44	75
1:00	83	56	15	34	49
2:00	72	95	27	25	52
3:00	69	82	29	21	50
4:00	73	62	20	23	43
5:00	63	58	22	29	51
Total	2355	1832	569	675	1244
Average	98.1	76.3	23.7	28.1	51.8
Max	154	149	37	44	77

Time	CCTL	CITPL	Terminal	ZeroGate	CFS
6:00	21	39	60	56	76
7:00	36	50	86	83	113
8:00	21	59	80	89	157
9:00	27	74	101	101	90
10:00	20	59	79	66	79
11:00	18	59	77	70	83
12:00	25	53	78	73	75
13:00	24	55	79	79	100
14:00	34	19	53	100	108
15:00	28	43	71	93	117
16:00	33	54	87	101	138
17:00	23	55	78	90	184
18:00	27	55	82	98	210
19:00	26	40	66	87	231
20:00	18	39	57	81	203
21:00	26	47	73	79	235
22:00	28	43	71	74	191
23:00	30	28	58	80	170
0:00	24	61	85	71	140
1:00	21	58	79	69	150
2:00	26	33	59	56	154
3:00	27	37	64	62	137
4:00	21	34	55	47	138
5:00	16	39	55	42	143
Total	600	1133	1733	1847	3422
Average	25.0	47.2	72.2	77.0	142.6
Max	36	74	101	101	235

Figure 3-36 Information published on ChPT Homepage

3-9. Current status of ports in the vicinity

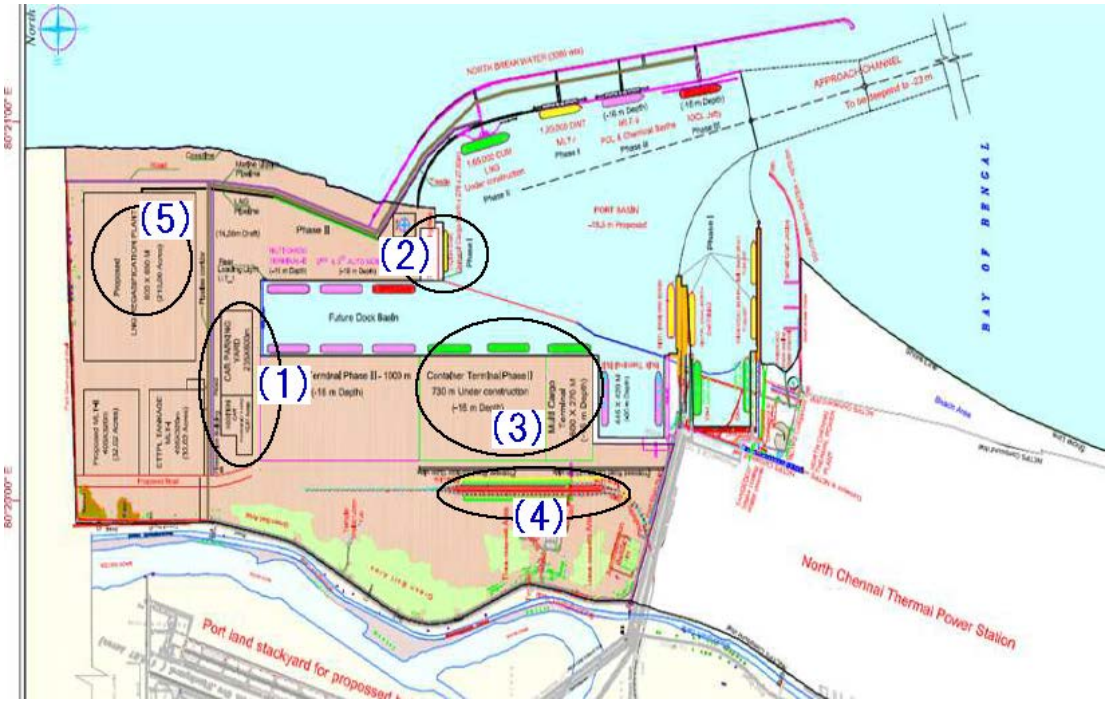
The ports of Kamarajar and Kattupalli have become strong competitors of Chennai Port for handling containers, complete cars, bulk cargoes etc. These ports have been rapidly developed in recent years. The Team conducted site surveys at these ports to grasp the status of development and current cargo handling levels. Based on the results, the Team will propose ways to modernize and improve operations at Chennai Port.

Table 3-11 Outline of Survey

Name of Port	Date of Visit	Company Assisted	Participants
Kamarajar Port	27/02/2017(wed)	MOL India	All members of the Team(7)
Kattupalli Port	06/03/2017(Mon)	NYK India	Four members
Kattupalli Port	11/08/2017 (Fri)	NYK India	All members of the Team(6)

3-9-1. Kamarajar Port

The current status of development and cargo handling situation at Kamarajar Port are as follows.



Source: Kamarajar Port Home Page

Figure 3-37 Kamarajar Port Master Plan

Kamarajar Port is developing container terminals, multipurpose terminals, liquid natural gas, coal etc. under a PPP scheme.

The container terminal which is being developed by ADANI is the major facility in terms of competition with Chennai Port. The location of the container terminal is indicated as (3) in the above layout. The quay will be 740 meters in length in the first stage; operation commenced in July 2017.

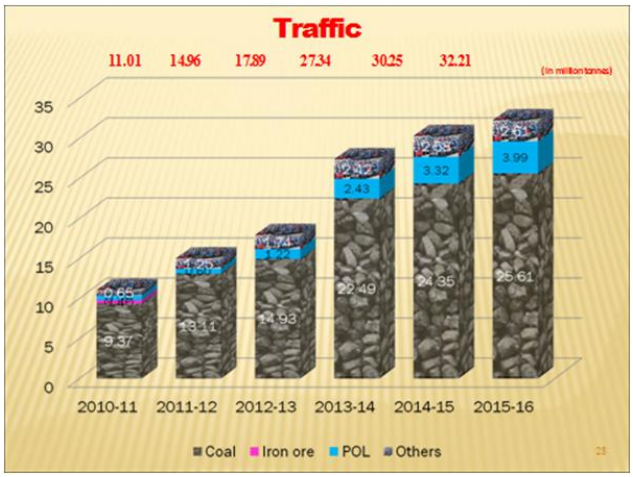
A railway line is also being established in the port (indicated as (4) in the layout map) for the transport of containers.

The multi-purpose wharf, which is 200m in length and -11m in depth, is mainly used for exporting new cars. The location of the multi-purpose wharf is indicated as (2) in the map. The carpool which is indicated as (1) in the layout map can accommodate 12,000 cars. When factoring in the storage capacity of 2,000 cars at the quay side, the total storage capacity becomes about 14,000 cars.

One more multipurpose berth is planned perpendicular to the current terminal. Development will start once consent is obtained from the Ministry of the Environment.

The development of the LNG storage tank is underway and it is scheduled to be completed in 2018. The location is indicated as (5) in the layout map.

The cargo volume handled at the Kamarajar Port is as follows.



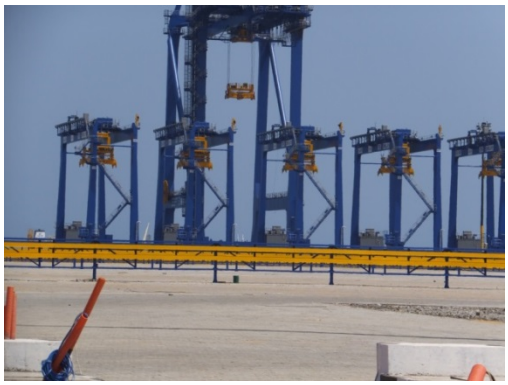
Source: Kamarajar Port home page

Figure 3-38 Cargo handling volume at Kamarajar Port

The volume of cargo handled in Kamarajar Port is increasing steadily. The port handles coal (about 8.5 to 9 million tons per year) which is transported to the Tamil Nadu State Electricity Authority (TNEB) thermal power plant, small amounts of iron ore and POL, and new cars. The cargo volume exceeded 30 million tons in FY 2014 (April 2014 - March 2015) and in FY 2015.

Kamarajar Port functions as a landlord port operated by a few core management personnel. The port entrance is open to the southeast and thus the port is sometimes subject to swells which hinder cargo handling activities.

According to Adani, the container terminal at Kamarajar Port was completed in July and was ready for use although no particular vessels are calling the terminal at the Team's visit in August. This terminal has an approximately 400m berth with a capacity of 800 thousand TEUs; the 2nd phase development works are currently underway. Adani plans to construct a Waiting Area for trailers in the same manner as their Kattupalli Terminal and has already reserved an 8 Acre (3.2ha) area of land.



Source: Google Map

Source: JICA Team

Picture 3-10 Current Status of Kamarajar Port

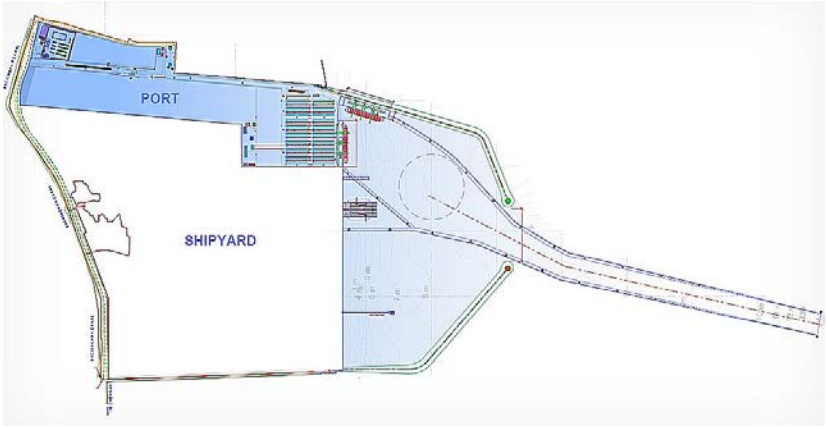
According to the news release, the central government has a plan to privatize some government-owned

ports, including Kamarajar Port even though the Ministry of Shipping has expressed its opposition to this plan. It is necessary to continuously monitor the progress of this plan.

3-9-2. Kattupalli Port

(1) General Overview

The current status of development and cargo handling situation at Kattupalli Port are as follows.



Source：Kattupalli Port website

Figure 3-39 Kattupalli Port Master Plan

Construction of the Kattupalli International Container Terminal (KICT) began in 2010 and operation commenced in June 2013. It has two quay walls (350x - 14, 360 x - 14), six gantry cranes and 16 RTGs. The handling capacity is reportedly 1.2 million TEUs. Container handling volume rapidly increased from 115,227 TEUs in 2015 (April 2015 to March 2016) to 347,956 TEUs in 2016 (April 2016 to Mar 2017). Since November 2015, Adani Group has been operating the container terminal.

Table 3-12 Container Handling Volume at Kattupalli Port (TEUs)

Name of Port	2014-15	2015-16	2016-17
Kattupalli Port	46,986	115,227	347,956

Source: Adani Kattupalli Port Pvt. Ltd.

The schedule of calling vessels for the week from 11th August to 17th August is shown in **Table 3-13**. The schedule seems to coincide with some of the port's main features.

Firstly, "Gate Cut Off time" is approximately 5-6 hours prior to vessel's ETA. According to Adani, last minute loading is available if container cargo arrives at the port a few hours before departure. This is an advantage for exporters such as manufactures.

Another specific feature is that TCX service calls Kattupalli port on Friday for import and on Sunday for export with a call at Chennai port on Saturday. It is also customer-oriented.

The schedule also shows calls of bulk cargo vessels and RORO vessels. In fact, some construction

machinery imported by a RORO vessel was stored in the yard on the day of the team's site survey.

Table 3-13 Vessel Schedule for the week of 11th August to 17th August

VESSEL NAME	ATA / ETA			ETB	Gate Cut Off	LoA	Service	Agent	Egm No & Date	Disc	Exp In Yard	Total
LIVORNO	11-Aug-17	FRI	06:00	07:00	IMPORT ONLY	260.00	TCX	SCA		440	0	440
SSL GUJARAT	12-Aug-17	SAT	08:00	09:00	13.08.2017 04:00	260.00	PIX2	SHR	132873 DT-08.08.2017		24	24
HAN ZHANG	12-Aug-17	SAT	12:00	13:00	BULK	107.43	BULK	JMBC				0
LIVORNO	13-Aug-17	SUN	10:00	11:00	13.08.2017 04:00	260.00	TCX	SCA			330	330
MAERSK BROOKLYN	14-Aug-17	MON	18:00	19:00	14.08.2017 12:00	294.10	SHTL	MSK	132509 DT-01.08.2017		186	186
MV COLORADO HIGHWAY	15-Aug-17	TUE	18:00	19:00	RORO	183.00	RORO	KKK				0
AS CARINTHA	16-Aug-17	WED	06:00	07:00	16.08.2017 01:00	222.16	CCG	SIM	132706 DT 04.08.2017	0	0	0
HYUNDAI PARAMOUNT	17-Aug-17	THU	06:00	07:00	16.08.2017 23:59	255.50	ACS	HMM	132852 DT 07.08.2017	0	4	4

Source: Kattupalli Port website

Source: JICA Team

Picture 3-11 Construction Machinery Imported by RORO vessel

According to Adani Kattupalli Port Pvt. Ltd. and other information sources such as shipping lines' website, the current ship calls at Kattupalli Port are as follows.

Table 3-14 Ship Calls at Kattupalli Port

Service	Lines	Frequency	Call at Chennai	Destination	Remarks
PIX2	Shreyas/ SCI	weekly	Yes	Dubai	
TCX	NYK/X-Press/COSCO	weekly	Yes	Thailand, Singapore, Malaysia	Double Call at Kattupalli
SHTL	Maersk Line	weekly	No	Colombo, Sarala	Call at Krishnapatnum
CCG	Evergreen/Simatech	weekly	Yes	Colombo, Dubai	
ACS	HMM/ GSL	weekly	Yes	Korea, China, Vietnam, Singapore, Malaysia	Call at Krishnapatnum

Source: Kattupalli Port and Shipping lines' website

Kattupalli Port is used by Japanese companies such as Komatsu, Sony and Panasonic, etc. In addition to containers, the port handles steel coils, reinforcing bars etc. Adani is eager to attract more Japanese customers to their terminals.

(2) Traffic flow of Trailers

The current status of facilities and queuing of container trailers at Kattupalli Port are as follows.

Entrance Gate is located two kilometres west of the container yard (CY) while a Truck Layby (Waiting Area for trailers) and Terminal Gate are found in between.

Source: Google Earth

Figure 3-40 Overview of Kattupalli Port

On the day of the Team's site survey, no trailers were queuing at the Entrance Gate, and the traffic condition was normal even though some trailers were waiting along the road to the Entrance Gate.

Source: JICA Team

Picture 3-12 Access Road to Entrance Gate

The traffic flow was also smooth inside the Entrance Gate.

Before reaching the Terminal Gate, there is a Waiting Area for trailers with a capacity of 80-90 trailers; document checks and other procedures are conducted here. This reduces the time spent at Terminal Gate. In future, Adani will construct an additional Waiting Area with a capacity of 200-300 more trailers.

Source: Google Map

Figure 3-41 Overview of Truck Layby and Terminal Gate

On the day of the Team's site survey, more than 20 trailers were parked at the Waiting Area for the procedures, and the traffic flow at the main road was quite smooth. In addition, the traffic flow inside the Waiting Area was also smooth because parking area is apparently separated from the trailer path.

Source: JICA Team

Picture 3-13 Trailers Parking at Waiting Space

The Terminal Gate consists of six lanes and an additional two lanes for heavy cargoes. Trailers proceed to the Terminal Gate after document checks and other procedures at the Waiting Area.

Each lane at the Terminal Gate has two booths, one for customs procedures, and one for terminal procedures. According to Adani, RFID will be utilized for customs procedures referring to data input at the CFS; it is already in use at the booth for terminal procedures where trailer drivers receive information about the location in CY they should reach.

Source: Kattupalli Port Website

Source: JICA Team

Picture 3-14 Terminal Gate

Unlike Chennai Port, an X-ray inspection machine does not exist at Kattupalli port; it will be installed by next year. Currently, container inspection is implemented by customs officers manually by opening containers and directly checking the contents. Since customs officers are stationed at the CFS near the terminal, the procedure is carried out quickly.

The ratio of Direct Port Delivery (DPD) in imported containers is approximately 40% which exceeds that of Chennai Port (currently below 20%). Adani does not collect DPD charges, which has increased the port's attractiveness.

On the day of the Team's site survey, 39,906GT container ship "LIVORNO" was berthed, and three quay cranes were in operation for unloading containers. According to Adani, one quay crane handles 30-35 containers per hour. Container handling was quite smooth.

Source: JICA Team

Picture 3-15 Handling of Imported Containers

(3) Expansion Capacity

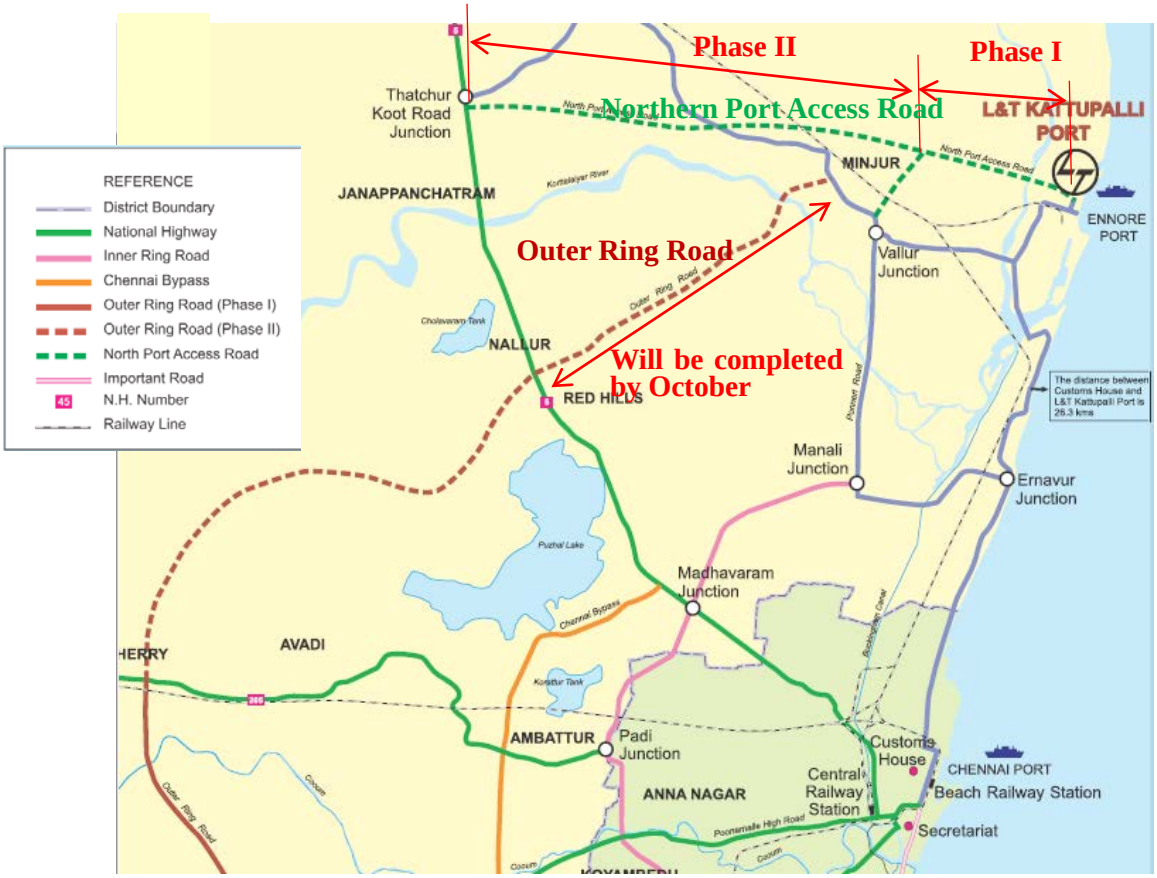
Kattupalli port possesses a lot of vacant areas. Various potential expansion areas are observed adjacent to the current CY. The capacity of the port could be increased by 0.6 Million TEUs once expansion works are undertaken.

Source: Google Earth

Picture 3-16 Overview of Container Terminal

(4) Connecting road to/from Kattupalli Port

According to Adani, the Northern Port Access Road[1] project has already started; priority is being given to the 10km of Phase I and the road to Vallur Junction. Although the state government will construct the road, four private bodies, including Adani, will support this project financially.
On the other hand, a part of the Outer Ring Road will be completed by October.



Source: Kattupalli Port Website

Figure 3-42 Northern Port Access Road and Other Roads Surrounding Kattupalli Port

3-9-3. Container Terminals in the Chennai Area

The main features of four container terminals in the Chennai area are shown in the table below.

Table 3-15 Comparison of Four Container Terminals

	Chennai DPW	Chennai PSA	Kattupalli Adani	Kamarajar Adani (Phase 1)
Handling Volume 2016-17	641,639TEUs	844,070TEUs	347,956TEUs	n/a
Berth Length (Depth)	885m (-13.4m)	832m (-15.5m)	360m+350m (-14m)	400m (-16.5m)

[1] The road is being developed by the state government to connect Kattupalli port and Kamarajar port with National Highway 5.

CY Area	21.4 ha	35 ha	20 ha	20 ha
Annual Capacity	1.5 M TEUs	1.5 M TEUs	1.2 M TEUs	0.8 M TEUs
Quay Crane	8	7	3+3	4
RTG	24	18	15	12
Ground Slot	3,842	5,424	5,120	n/a
Direct Rail Access	Yes	Yes	No	Yes

Source：DPW, PSA, Adani Website and Hearing from Adani Group, etc.

3-10. Interview with Port Users

The Team interviewed the users of Chennai Port in order to obtain their opinions on port facilities and operation. Users interviewed were four (4) Indian associations, one（1）Korean company and eight (8) Japanese companies. Main comments from port users are shown below.

3-10-1. Indian users (and one Korean user)

(1) Is Chennai Port user friendly or not?

- Berth ratio between JD and AD is relatively high. This means either volume might be high or handling efficiency is low. Port System should be modernized
- Main problem we are facing is infrastructure bottleneck inside the port like insufficient roads to manage the traffic.
- Usage of Gate No. 10 is restricted between 11.00 p.m.to 5.00 a.m. for Car Carriers.
- Adequate space capable of storing at least 6,000 cars with concrete or paved surface is required and it should be separated from the unloading area.
- ChPT should increase the unloading capacity of loose cargoes through the use of conveyor belts, etc.
- As of now, ChPT is preferable in terms of project cargo handling.
- In future, all three container terminals will get business.
- Chennai Port should maintain and improve efficiency.
- Maduravoyal – Chennai Port Elevated corridor will improve the traffic flow.

(2) Facilities inside the Port

- BD2 can be converted into a continuous quay.
- Timber yard reclamation can be done as there are no bidders. West quay can be used for tug boat repair. Reclamation is possible.
- In general, warehouse is not sufficient. However, AD is presently utilized for car handling which is not good planning.
- Facilities are very limited inside the port due to lack of sufficient space.
- Berths are adequate presently considering the market scenario. If the economy improves, the

present berths will not be adequate to handle the cargo.

- Dr. Ambedkar Dock and Jawahar Dock cannot be utilized fully due to their old structural design and cannot accommodate more bulk cargo. Cars can be accommodated but the storage area is very dirty.
- Shallow water jetty needs to be developed to accommodate barges for project cargoes.

(3) Ship maneuvering

- Regarding the entrance of the JD, if the government allows the handling of dusty cargo, expansion of the entrance by 8 meters should be examined to accommodate future generation ships.
- Currently the JD entrance is about 33 meters. In the meeting with the Team, it was suggested that JD entrance can be widened up to 48 meters. Based on the current condition, 44 meters may be enough because the width of post Panamax vessels is only 44 meters. The current available draft is 12.5 m to 13 m. In order to widen the JD entrance, the draft should be 15.5 m plus 1m allowance.

(4) Traffic inside the Port

- Traffic flow inside the port could be improved by constructing a flyover
- Waiting space should be provided nearby the traffic route.
- Smooth traffic flow inside the port is the biggest hurdle in the growth of ChPT as currently proper access to the port is available only for 6 hours a day. Reason for entry restrictions is due to usage of PH Road to approach Gate No.10 which is situated inside the city.
- Traffic flow inside the port needs to be improved. There are extensive delays from Gate No.1 to terminals. Large vessels have diverted their calls to nearby ports. Nearly 30 thousand cargoes have been moved to nearby ports.
- There should be separate lanes for Container and Break bulk cargoes inside the port similar to Tuticorin Port.
- JICA study team’s suggestions and proposals have not been implemented properly and thus congestion still exists inside ChPT

3-10-2. Japanese users

(1) General

- Traffic congestion outside Chennai port has been improved; however traffic inside the port is still congested.
- Port facilities and cargo handling facilities are old and insufficient. Environment of the cargo handling area is not good due to severe dust and the narrow handling area.

(2) Traffic inside the port

- There is heavy traffic of container trailers and tank & bulk trucks inside the port.

- The existing areas of DPW and PSA terminals are often congested.
- Container trailers bound for PSA terminal and bulk cargo trucks from/to Jawahar Dock are often stalled at the crossing points.
- Traffic regulations should be introduced and enforced.

(3) Deteriorated and narrow cargo handling facilities

- The current berths and yards are so old, dirty and dusty that it is not a good environment for storing loading/unloading the parts of the products, commodities and so on.
- The yards behind the berths are insufficient for stocking Ro/Ro cargo.
- Equipment such as forklifts needs to be procured for the improvement of cargo handling at berths.
- It takes a long time to come along the quay due to deteriorated fenders.

3-11. Environmental Management

3-11-1. Environmental Impact Assessment (EIA) in India

Consistent with Japan and JICA's guidelines, the background for Environmental Impact Assessment in India can be traced to Principle 17 of the Rio Declaration on Environment and Development (to which India is a signatory) which states that "Environmental Impact Assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."

(1) Relevant Laws

The Environment Protection Act was enacted in 1986 in response to the need to protect and improve the environment. This Act allows the Central Government to establish authorities to prevent degradation of the environment and deal with specific environmental issues throughout the country. Various rules and notifications have been established under this Act; those most pertinent to ports are as follows:

1. Environmental Impact Assessment Notification
2. Coastal Regulation Zone Notification

It should be noted that minor ports (ports managed at the state level) come under the Coastal Regulation Zone Notification law.

Other key laws are the Water (Prevention and Control of Pollution) Act 1974 and the Air (Prevention and Control of Pollution) Act 1981.

(2) Regulatory Authorities

1. The Ministry of Environment, Forests and Climate Change (MoEFCC) plans and oversees India's environmental policy and programs including EIA.
2. Central Pollution Control Board (CPCB) adopts national environmental standards under various

environmental laws, advises the central government on pollution matters, maintains a database on pollution matters and offers technical assistance to State Pollution Control Boards (SPCBs).

3. The SPCBs grant companies permission to establish and operate an industrial plant/factory in air or water pollution control areas. In addition, companies must obtain permission from SPCBs when intending to carry out any activities regulated by environmental laws. The SPCBs also approve or reject renewal applications.

(Note: In India, the preferred term seems to be 'consent' rather than 'permission.')

(3) Environmental Impact Assessment (EIA) Procedure in India

Similar to the case of Japan, projects are categorized into Category A and B. Category A projects require environmental clearance from the Central Government on the recommendations of an Expert Appraisal Committee. Category B projects shall require the clearance from the State/Union Territory Environmental Impact Assessment Authority, whose decision shall be based on the recommendations of a State or Union Territory Environmental Impact Assessment Authority. In the case of ports and harbors, EIA is a mandatory requirement as per the Ministry of Environment, Forests and Climate Change (MoEFCC) EIA Notification of September 14, 2006 and is also governed under CRZ Notification of February 1991 (most recently amended in 2011). Port and Harbor projects fall under activity No. 7(e). A project is classified as Category A if the cargo handling volume exceeds 5 million tons per year.

There are four stages to obtain environmental clearance.
Stage 1 – Screening: the Expert Appraisal Committee examines the application submitted by the project proponent and determines whether or not an EIA needs to be prepared.

Stage 2 – Scoping: The Appraisal Committee determines the TOR for the preparation of an EIA report, addressing all relevant concerns.

Stage 3 – Public Consultation: Public hearings are conducted to grasp the concerns of affected persons and stakeholders and reflect them in the project.

Stage 4 – Appraisal: The Appraisal Committee gives a detailed examination of the application including the EIA report and outcome of public consultations. It then makes recommendations to the regulatory authority concerned as to whether the projected should be approved or rejected.

Note: EIAs can only be conducted by consultants duly accredited by the Quality Council of India/National Accreditation Board of Education and Training (QUI/NABET).

3-11-2. Survey of monitoring stations inside the port

There are 12 sampling stations for ambient air quality levels in Chennai Port. A private contractor (Ramky Enviro Engineers Ltd., Hyderabad) has been engaged to monitor and record various environmental parameters, namely, PM10, PM2.5, NO2, SO2, etc. on a monthly basis. The private contractor not only submits the collected data to ChPT but also makes recommendations on ways to improve the air quality.

At present, levels of PM10 exceed the permissible limit set by the Central Pollution Control Board (CPCB) of India which is 100 µg/m3 (see the table below). However, it should be noted that the standard permissible limits of India are substantially less stringent than those of WHO, Europe, North America as well as Japan (the permissible limit is generally set at 50 µg/m3 in most developed countries). Long-term exposure to current levels of PM10 poses a health threat to port workers and persons living near the port premises. Therefore, the introduction of measures to reduce the current PM10 levels would seem to be an urgent matter。

Table 3-16 Monitoring Results of Key Environmental Parameters inside Chennai Port

Month of Sampling		**January 2017**								
Location Code		**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	**A11**	**A12**	**CPCB Standards**
Particulate Matter (PM_{10})	$\mu g/m^3$	76	84	165	155	138	118	112	152	100(24Hour)
Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	26	28	48	42	38	32	30	45	60(24Hour)
Sulphur Dioxide (S02)	$\mu g/m^3$	7.1	7.8	8.9	11.2	10.2	9.3	8.8	10.2	80(24Hour)
Oxides of Nitrogen (NOx)	$\mu g/m^3$	34.3	35.2	37.8	38.7	35.8	36.2	34.6	34.8	80(24Hour)

Source: Environmental Cell, Civil Engineering Department, ChPT

On May 3rd, 2017, two members of the Team conducted a survey of the monitoring stations in Chennai Port in the company of Dr. K. Kathiravan, Manager of the Environment Cell of the Civil Engineering Department and his two assistants, Mr. M. Gunasekar and Ms. L. Nirmal Veera Rajakumani. As previously mentioned, there are 12 sampling stations throughout the port where separate monitoring instruments for particulate matter and gases have been installed (see the photos below).

Picture 3-17 Air Quality Monitoring Station A2

Picture 3-18 Air Quality Monitoring Instrument for NO2 and SO2 at Station A4 (Fire Office)

Picture 3-19 Air Quality Monitoring Station which will generate real time environmental data online

Picture 3-20 Source of dust near Jawahar Dock

In addition, the Team learned that ChPT was erecting display panels to make air quality levels public at 2 or 3 locations near port gates. The Team was confirmed that the display panels were erected during the 11th dispatch and publication of air quality data such as PM2.5, PM10, CO2, NOx and CO had commenced before the 12th dispatch. ChPT is clearly committed to improving the environment of the port. The Team will put forth its best efforts to recommend practical solutions to the environmental problems faced by the port. At this preliminary stage, the generation and dispersion of dust seems to be the biggest contributing factor to the high levels of PM10 recorded at port work zones. Accordingly, the Team will focus its efforts on measures to reduce dust generation. It should also be noted that under Indian law, an Environmental Impact Assessment (EIA) will need to be conducted for all port-related projects.

Picture 3-21 Display in front of ChPT HQs

Picture 3-22 Display at Port Gate No.10

3-11-3. Baseline data on environmental parameters

In line with world trends, there is a growing recognition among the Indian population of the need to protect and improve the environment. ChPT is committed to enhancing the environment of the port and has introduced a 'Maritime Pollution Management' system to protect marine life and improve the ambient air quality. A private contractor (Ramky Enviro Engineers Ltd., Hyderabad) has been engaged

by ChPT to monitor and record various environmental parameters on a monthly basis.

The Team examined the data on environmental parameters at Chennai Port for the last 5 years. There has not been any significant change in key environmental parameters during that period.

3-12. Information for Customs Procedures

(1) Computer system for Customs in India

In India, customs clearance is performed using ICES (Indian Customs EDI System). ICES, following the trial of the pilot project at Delhi customs house in 1994-95, gradually came into use at other customs houses from 1997. It is currently operational throughout the country and almost all import / export Customs procedures are performed using ICES.

ICES is similar to the Nippon Automated Cargo and Port Consolidated System (NACCS) which is used for customs clearance and related procedures in Japan. However, ICES is regarded just as a tool for data exchange for the import / export customs declaration and clearance procedure while NACCS is regarded as the system for custom clearance itself. The signature of a Customs officer is required for final approval for each level (preventive / examining / appraiser) in ICES though all the necessary documents are transmitted electronically. As a result, decisions of Indian Customs can vary from one officer to another whereas approval is given electronically in NACCS and thus inconsistencies are rare. Furthermore, RMS (Risk Management System), which is similar to CIS (Customs Intelligence Database System) in Japanese NACCS, was introduced in order to improve the Customs procedure for import cargoes in 2006. RMS automatically decides the level of customs inspection such as physical check, documentation check, self-check, X-ray check, etc.

Only the Customs House Agent (CHA), licensed customs brokers, can access the ICES in principle but the importers / exporters can use the system as well after receiving the approval of Customs. As for the usage of ICES, the CHA or importer / exporter registers or transfers the data of various import / export documents using the client terminal of ICES in the customs service center or using the GUI (Graphical User Interface) based package software for ICES, called ‘Remote EDI System’, which can be implemented in his own PC.

(2) Ease of doing business

The Government of India is attempting to raise India’s ‘ease of doing business’ ranking (published by the World Bank) in order to promote foreign investment in India based on the Make in India Initiative announced in 2014. Along with this movement, the government has taken several measures such as ratifying WTO (World Trade Organization) / TFA (Trade Facilitation Agreement), etc. while Customs has taken several measures including those described below.

1) DPD (Direct Port Delivery)

DPD is a customs clearance facility where cargoes handled by an authorized AEO (Authorized Economic Operation defined in WTO/TFA) can skip physical checking in principle in Customs

clearance procedure. DPD was originally introduced in Jawaharlal Nehru Port and it has been successfully operated. In Chennai Customs Zone, the scope of DPD has been expanded by the following facility circulars.

a) Chennai Customs Facility Circular No.23/2016 dated 25.10.2016

- DPD facility opened in Chennai for import containers of ACP clients and of Automobile industry related consignment

b) Chennai Customs Facility Circular No.05/2017 dated 28.02.2017 effective from March, 2017

- DPD facility is enhanced for 224 companies who are AEO clients or operating automobile manufactures consignments
- DPD cargoes are given priority in processing
- 'RMS Facility Center' has opened in Customs House in Chennai on a 24-hour, 7-days-a-week basis. Users can complete the process for Customs clearance for DPD containers at the RMS Facility center.
- DPD container must be evacuated from a container terminal within 48 hours after vessel discharge

ChPT is now trying to increase the ratio of DPD from 20% to 40%.

2) CCFC (Chennai Customs Clearance Facilitation Committee)

CCFC was organized for each Customs Zone according to the instruction by the Government of India in order to discuss various improvements related to Customs Clearance among stakeholders. In Chennai Customs Zone, CCFC meeting has been held once a month since early 2015. The attendants of the meeting are senior Customs officers, ChPT, Kamarajar Port, Kattupalli Port, Airport authority of India, Drug Control, FSSAI, CONCOR, Plant / Animal Quarantine, Bureau of Immigration, Tamil Nadu Pollution Control Board, NACFS, Chennai / Ennore Steamer Agents Association, CCTL, CITPL, Chennai Customs Broker Association, etc. (Even JETRO has once attended the meeting). According to the minutes of these meetings, various items regarding the improvement of Customs related operation are discussed. The major items concerning Chennai/Kamarajar/Kattupalli Port discussed lately are as follows.

- Status of RFID system
- Facilities for X-Ray inspection
- Direct Entry of Factory Stuffed Export Containers
- Shifting of Customs checking from Terminal to Port gates
- Dispensation of seal verification at terminal
- E-Delivery order
- RMS facilitation center
- Online connectivity at Port

(3) Introduction of GST (Goods and Service Tax)

The Indian government rolled out the new indirect tax regime – GST from July 1 2017. The indirect tax was greatly simplified by the introduction of GST.

The Customs has lately allowed self-sealing for a factory stuffed containers along with the introduction of GST.[2] The export procedure for factory stuffed containers is slightly simplified by this change because neither the sealing work at the factory nor the re-sealing work at CWC is needed by Customs officers. Furthermore, the Customs also ordered to use an Electric-seal (a seal with RFID function) for self-sealing in the Facility Circular which allows the self-sealing above.

In this way, the introduction of GST may indirectly improve the traffic flow of container trailers inside and outside Chennai Port.

(4) Interviews with stakeholders

The Team conducted interviews with stakeholders. Their main comments are summarized as follows.

1) Overall

- When examining an export container, opening the special packing (vacuum packing, wooden frame packing, etc.) should be avoided as re-packing is costly and difficult.
- A shipper is sometimes forced to go back and forth between Customs offices due to the conflict of views between a Customs officer of the central excise at a factory and an export officer at CFS/CWC.

2) Customs officers

- The role of a Customs officer is categorized into multiple authorities (appraiser, examiner, preventive. etc.);
  - The Customs process stops if one of the officers is absent
  - Users may be forced to visit multiple CFS because officers of all the categories may not stay in a CFS
  - Customs officers sometimes have conflicting views
- Customs officers often leave their offices

3) Indian Customs EDI System (ICES)

- The system stops once a year for a long time in order to change the tax rate; the whole Customs process stops during this period.
- The system still requires stamps and an officer's signature. It is essentially a manual system.
- The system process has improved; the processing speed is faster than 2 years ago.

4) Comparison with Kattupalli

- A user must visit Chennai Port as well as Kattupalli Port when applying for a vessel call at Kattupalli Port.
- In Kattupalli Port, an import container can be picked up from the container terminal just by the E-DO (Electronic Delivery Order), while the Form 13/DRF (Delivery Request Form), which requires Customs confirmation as well, is required in Chennai Port.

[2] Until then, a Customs officer in charge of central excise sealed a container by a dedicated seal at a factory and an officer in charge of export replaced it with an export seal at CWC near the Port.

Chapter.4 Outcome (Evaluation), Challenges and Recommendations

4-1. Framework of the Technical Assistance Phase II

The Team has implemented the Phase II project following the Phase I project in collaboration with ChPT and organizations concerned. Measures conducted during the Phase II project are shown in the following figure in the framework of the Phase I project.

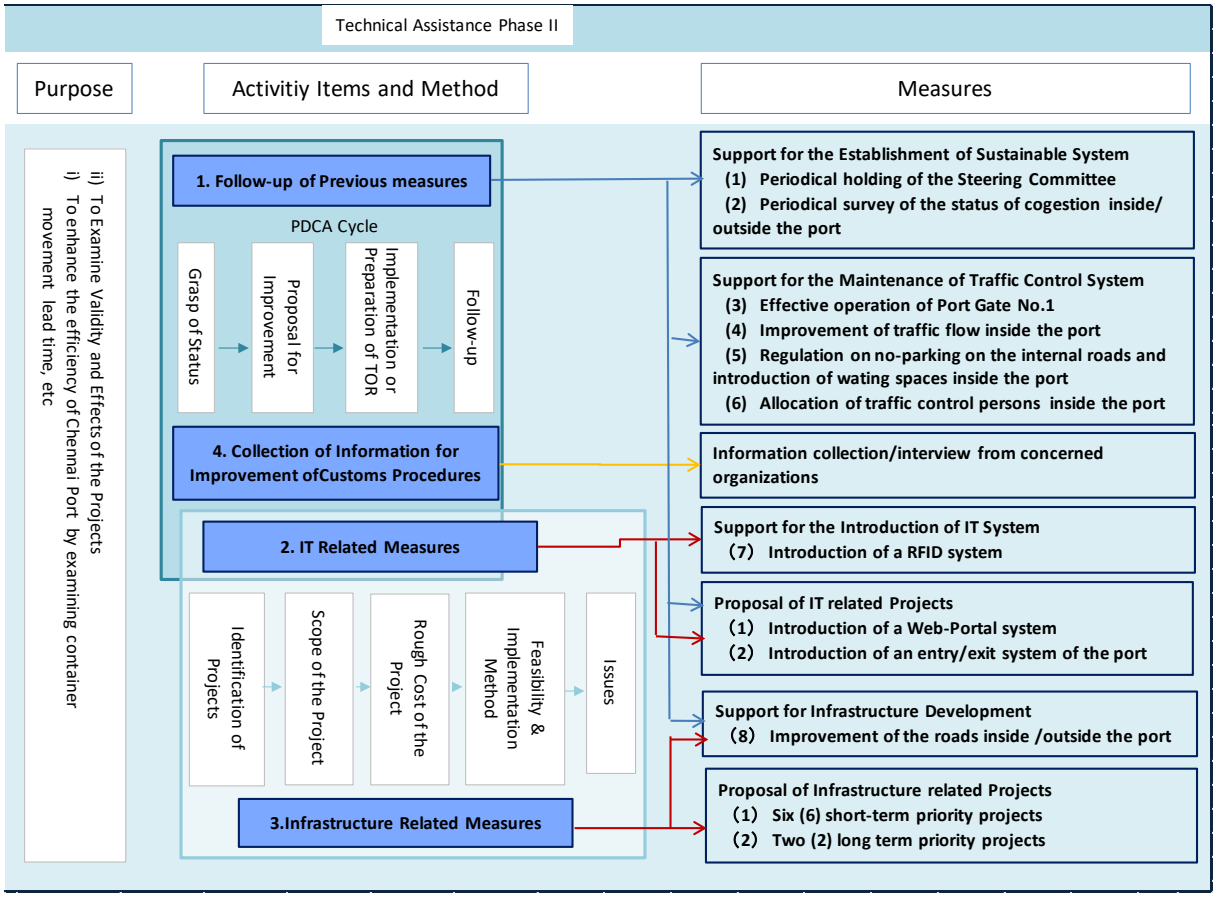


Figure 4-1 Measures conducted during the Phase II project

Among measures conducted in the Phase II project, the operational improvement measures are evaluated and their issues and recommendations are compiled in the following section.

4-2. Evaluation, Issues of the Operational Improvement Measures and Recommendations

4-2-1. Periodical holding of the Steering Committee (S/C)

The Steering Committee (S/C) has been held throughout the project period to discuss and determine basic directions for implementing measures of congestion alleviation. Measures for improving and modernizing the operation of the port have been discussed in S/C as well. S/C consists of ChPT, concerned authorities and stakeholders; it has been a useful vehicle for sharing information and

strengthening cooperation and coordination among concerned authorities and stakeholders. In the Phase II project, positive and constructive discussions on the issues and proposals introduced by the Team were made in S/C under the leadership of the Chairman of ChPT. Periodical holding of S/C contributed to deepening the understanding among the concerned authorities and stakeholders on the congestion issues which enabled each measure to be implemented effectively.

Therefore, after completion of the technical assistance, S/C will continue to be held periodically to promote the improvement of port operation under the coordination of authorities concerned and stakeholders. The Team has proposed a TOR (Running Rules for the Committee for Implementation of Port Operation and Management) for strengthening the relationship among the authorities concerned and stakeholders.

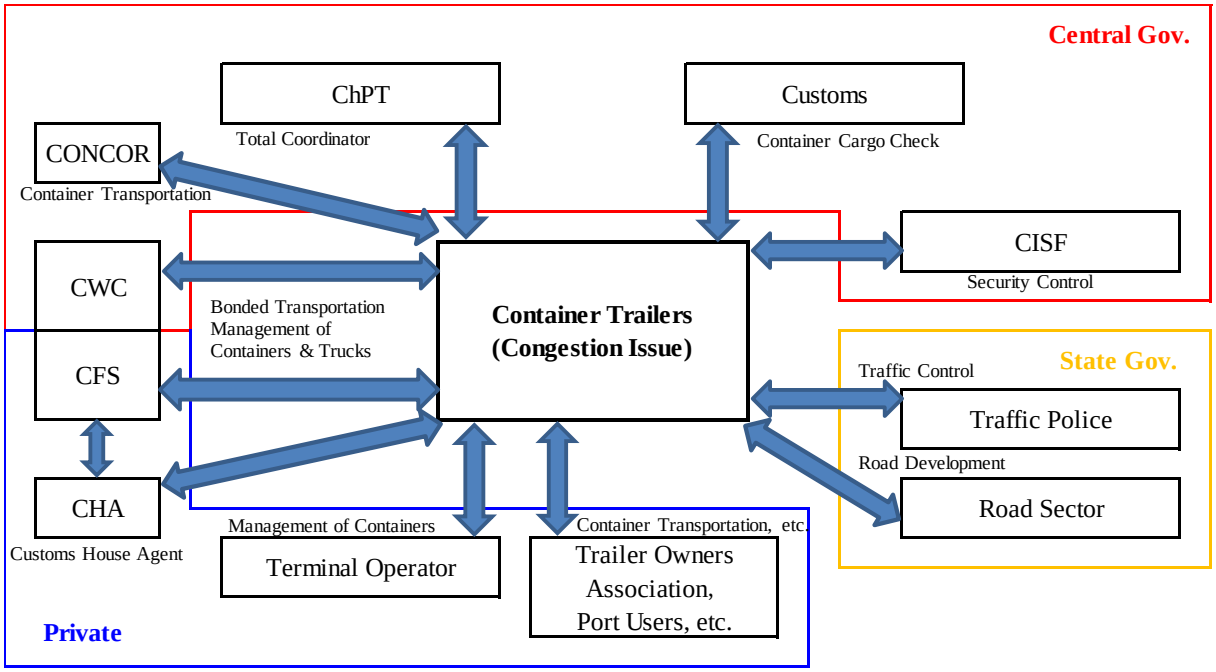


Figure 4-2 Congestion Issue and Concerned Organizations

4-2-2. Periodical survey of the status of congestion inside/outside the port

The Team has conducted the congestion surveys inside/outside the port and other necessary surveys related to congestion through the 12 times of technical assistance periods from July 2014 to October 2017. These surveys were of great help in grasping the status of congestion and proposing measures for reducing congestion.

Thanks to the efforts of ChPT, concerned authorities and stakeholders, congestion has been easing; however there are still many issues to be solved. Lack of discipline on the part of drivers and noncompliance with traffic rules are issues which must be addressed to further alleviate congestion. Periodical congestion surveys should also be carried out in order to grasp the status of problems, draw up measures and implement them.

Table 4-1 Evaluation of Congestion Measures outside the Port and Challenges

Item	Measure	Evaluation	Challenge
Traffic control at Manali junction	Traffic control by traffic police	Not sufficient (no consideration for congestion status)	To secure even traffic flow responding to congestion status of the westward and northward
Setting of blocks for trailer lanes	Securing dedicated lanes for trailers	Sufficient	
Utilization of TVT-Parking	Waiting area for drivers without proper documents	Not utilized	To consider the utilization and to develop running rules
Adjustment of traffic flow by traffic police	/ Prohibition of parking at intersections, overflies, narrow section of roads, residential areas / Instructions to drivers who do not move forward despite there being space in front	Not sufficient (inefficient traffic control; drivers have not been instructed to go ahead even when space is available or driver have been instructed to go ahead so that new congestion occurs in back and front	/ To introduce means for traffic police to communicate each other / Strict enforcement of the no parking regulation / Continuous patrol by traffic police and warnings to drivers who have parked
Improvement and widening of access roads	Development of dedicated lanes for trailer along the access roads	In progress (Separation of trailer flow and ordinary traffic flow)	Work needs to be completed as soon as possible

4-2-3. Efficient operation at Port Gate No.1

The Team has made necessary proposals for efficient operation at Port Gate No.1 through the observation of the operational status around Port Gate No.1 conducted as the follow-up to demonstration trial 1. Notably, the Team pointed out to ChPT that the reception procedure at Port Gate No.1 had been changed and it was one of the major reasons for the recent increase in traffic congestion outside the Port during the 11th dispatch.

ChPT has to put in place a system which makes it possible to grasp any changes in operational procedure as it will be necessary to ChPT to solve the issues by themselves in future.

4-2-4. Improvement of traffic flow inside the Port

The Team examined the traffic flow inside the Port and identified the following issues and countermeasures during the 10th dispatch.

Table 4-2 Major Issues and Countermeasures in Traffic Flow inside the Port

Area	Issues	Countermeasures
North side	Import trailers for X-Ray inspection have to cross another trailer flow at the intersection near the inspection area	To implement a new X-Ray inspection area dedicated for import containers along the traffic flow of import trailers
	Two empty trailer flows towards DPW merge	To unify empty trailer flow so that empty trailers coming from PSA join the flow at Port Gate No.1
Central	Too many types of trailer flow are mixed on a narrow road	To implement realignment/development internal roads proposed by the Team
South side	The access road for coastal cargoes is occupied by empty trailers towards PSA East Gate	To establish a new waiting area for empty trailers and change the empty trailer flow accordingly

Furthermore, the Team pointed out issues related to the trailer flow to and from the X-Ray inspection area and recommended short-term improvements during the 11th dispatch. It is recommended that the countermeasures proposed by the Team be implemented immediately.

4-2-5. On-street parking ban inside the Port and establishment of a new Waiting Area

The Team conducted the demonstration trial aiming at the introduction of an on-street parking ban inside the Port during the technical assistance (Part I). The Team pointed out that on-street trailer parking inside the Port was regularly observed during the technical assistance (Part II) and that this was one of the factors inhibiting an optimum trailer flow. However, on-street trailer parking along the traffic flow has not been decreasing. Furthermore, many tank trailers are also parking lately along the outgoing traffic flow towards Port Gate No.1.

The Team proposed that a new Waiting Area be established for empty trailers near PSA Main Gate as one of the countermeasures for improving the traffic flow inside the Port during the 10th dispatch (refer to **4-2-4** above). The Waiting Area is not for trailers waiting for documents but for trailers which are ready for terminal gate reception. The Team also proposed that new Waiting Areas be established for both empty and laden trailers near the terminal gates of both container terminals including their arrangement and operational procedure during the 11th dispatch. Establishing these Waiting Areas will contribute to alleviating the traffic congestion outside the Port, coupled with further improvement of the efficiency at Port Gate No.1[3]. Moreover, it is recommended to strictly enforce the parking ban

[3] A Waiting Area inside the Port will not be effective unless Port Gate No.1 releases more trailers than the capacity of handling trailers at terminal gates.

along the access roads as well as the waiting area in accordance with the established operation rules.

4-2-6. Allocation of traffic control persons

The allocation of traffic control persons conducted as the demonstration trial during the technical assistance (Part I) has continued. Places where traffic control persons are allocated have been gradually increased and they are giving instructions to drivers more vigorously than in the past. However, places where traffic control persons are allocated must be continuously examined and re-evaluated. For example, traffic control persons may have to be allocated near Port Gate No.4 and along the outgoing trailer flow towards Port Gate No.1 as incidents of on-street parking have been observed there.

4-2-7. Introduction of RFID system

ChPT, NACFS, both container terminals, and Customs office inside the Port have introduced the RFID system in order to simplify the entrance and exit procedure at several gates. The system aims at improving the efficiency of the reception procedure by obtaining the cargo information and relaying the delivery instruction information to trailers automatically upon reading a RFID tag which is installed on the front glass of a container trailer. However, neither the container terminals nor ChPT currently utilize the information obtained from the RFID tag at all. Both container terminals have to link the Terminal Operating System (TOS) with the RFID system in order to improve the efficiency of terminal gate operation. ChPT has to examine the usage of the data collected by the RFID system based on the demonstration trial of the Web Portal System which is currently being conducted.

ChPT is considering the introduction of the RFID system for Port entry/exit control. The system would replace the paper-based HEP with an RFID card. This would not only enhance the existing Port entry/exit control but also improve the efficiency of the reception procedure. The Team has supported the introduction of the system and has recommended that RFID tags be shared with the RFID system, which is currently operated by NACFS, etc. ChPT has to introduce the RFID system for entry/exit control as soon as possible in order to improve the efficiency of the reception procedure and to enhance the functionality of Port entry/exit control.

4-2-8. Improvement of road infrastructure outside the Port

The Ennore Manali Road Improvement Project (EMRIP) has been carried outside the Port for more than 10 years mainly by the Tamil Nadu state government. The aim of the project is to improve roads from Port Gate No.1 to Kamarajar Port. Approximately 95% of the project has now been completed with work pending on only on two parts: one at NTO Kuppam along the SH114 and the other near Port Gate No.1 along the access road from SH114 to Port Gate No.1. As for the former, the relocation of the residents and the demolition of their houses have been completed and only the road expansion work and the lane separation for container trailers remains. In the case of the latter, however, the work has been suspended for more than a year. It should be re-started as soon as possible in order to

improve the trailer traffic flow to and from Port Gate No.1. Both the dedicated lane for trailers around the narrow part of the state road 114 and 4 lane access road behind the fishing harbor have to be completed as soon as possible.

The road improvements and enhancement have been continuously conducted inside the Port as well as the clear lane separation. Such works have contributed to the improvement of the traffic flow inside the Port to some extent. Therefore, continuous efforts for improvement of infrastructure are expected.

4-3. Objective Evaluation for the Technical Assistance and Recommendations

4-3-1. Evaluation of measures for congestion alleviation outside the port and challenges

The Team has surveyed the congestion status outside the port from the beginning of the project. **Figure 4-3** shows the results of the regular traffic check by the Team which includes the maximum and average number of queuing trailers, corresponding monthly container handling volume, and export container handling volume in time sequence.

According to **Figure 4-3**, maximum and average number of queuing trailers has been steadily decreasing. In particular, average number of queuing trailers decreased to 146 even though the container handling volume increased during the 10th dispatch. On the other hand, maximum and average number of queuing trailers have increased during the 11th dispatch even though export containers were almost stable. Changes of operation procedures at Port Gate No.1 and burying works of pipelines along SH114 from Chennai port to the oil refinery near the Manali area are thought to be major causes of the heavy congestion and the increasing number of queuing trailers. The number of queuing trailers significantly decreased during the 12th dispatch despite the number of handling container was almost the same level as before. It is thought to be an effect of Diwali holidays.

	Data Collection Survey	1st Dispatch	2nd Dispatch	3rd Dispatch	4th Dispatch	5th Dispatch	6th Dispatch	7th Dispatch	8th Dispatch	9th Dispatch	10th Dispatch	11th Dispatch	12th Dispatch
Maximum/day	1,097	1,024	1,478	568	709	754	849	874	497	716	526	711	487
Average/day	819	373	467	162	336	274	441	505	253	257	146	474	145
Handled Container (TEU) /Month	121,315	134,506	129,281	113,078	137,301	142,087	134,526	129,091	119,138	105,977	130,545	132,390	128,631
Reference: Export volume (Laden Container)	53,181	54,756	51,047	49,047	51,416	50,554	47,938	44,950	33,366	37,602	36,181	35,377	34,590
Export share	43.8%	40.7%	39.5%	43.4%	37.4%	35.6%	35.6%	34.8%	28.0%	35.5%	27.7%	26.7%	26.9%

Figure 4-3 Trend of Congestion Status outside the Port

The status of congestion outside the port has changed with each dispatch as can be seen above; however as an overall trend, congestion has steadily been decreasing and queues exceeding 1,000 trailers has no longer observed. Port users including Japanese companies have also said that the congestion status of Chennai port has significantly improved.

However, there is still congestion outside the port; therefore sustainable efforts to tackle congestion in collaboration with all stakeholders are required.

4-3-2. Evaluation of the lead time results and its challenges

Evaluation and challenges of the measures conducted from the viewpoint of the lead time survey are as follows.

Following figure shows the survey results of lead time (a total of 12 surveys were conducted). A gradual decreasing curve can be applied to explain the trend of the lead time.

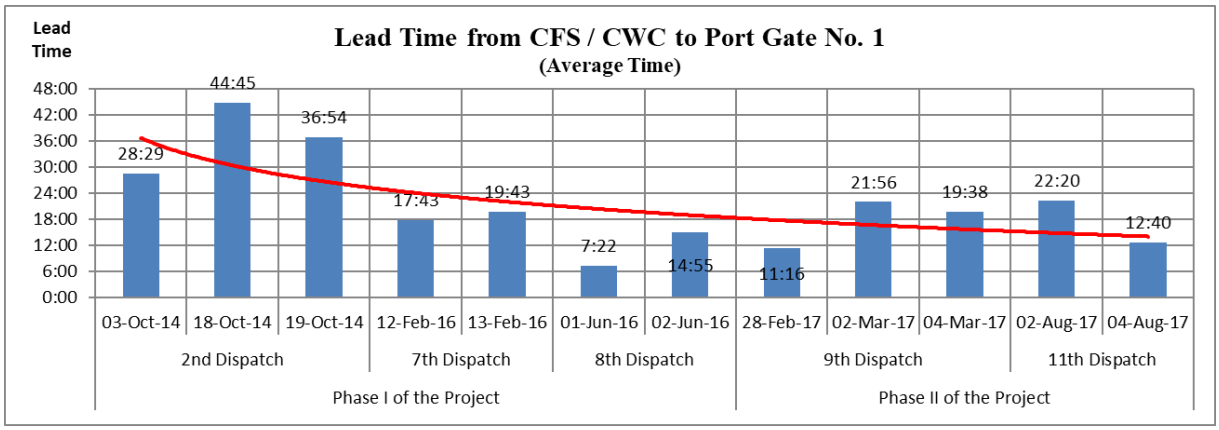


Figure 4-4 Survey Results of the Lead Time

Though the lead time fluctuates by survey date, lead times of around 40 hours which were recorded at the initial stage of the Phase I project have not been observed in recent days. The lead time has steadily decreased.

The lead time is considered to depend on a variety of factors such as the status of congestion, the status of traffic regulation, the status of road conditions, etc. However, the lead time, in general, is considered to become shorter as the number of queuing trailers decreases. Relations between these two indices are shown in **Figure 4-5**. (Two indices are recognized to have a correlation since square of correlation coefficient (R^2) is 0.5039.)

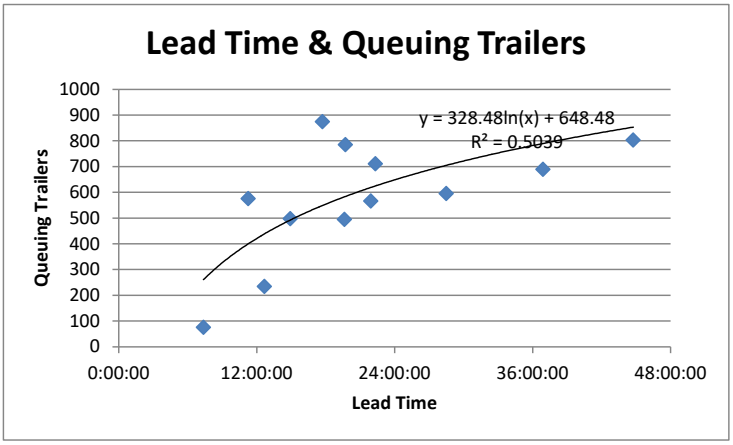


Figure 4-5 Lead Time and Number of Queuing Trailers

This figure shows that the lead time becomes shorter with the decrease in the number of queuing trailers though there are some fluctuations.

Shortening of the lead time can be confirmed from the analysis of RFID data shown in the next section.

As explained above, the lead time has been steadily decreasing. It seems that a variety of measures conducted in collaboration with organizations concerned brought positive results. Such measures should be continuously conducted in cooperation with ChPT and stakeholders and a sustainable system should be established to tackle congestion and improve port operations.

4-3-3. Reduction of the Reception Time at Port Gate No.1

The following figure shows the transition of time required for entry/exit procedures at Port Gate No.1. It was reduced by implementing the demonstration trial 1 (Introduction of Bar Code Reading system for simplification of the Gate Procedure). Although the trial was completed in August 2015, the reception time has been reduced after that thanks to the efforts by stakeholders such as CISF, etc. As the reception time at Port Gate No.1 greatly affects the congestion outside the Port, the stakeholders have to grasp the changes in processing time there and take necessary actions to reduce it whenever necessary.

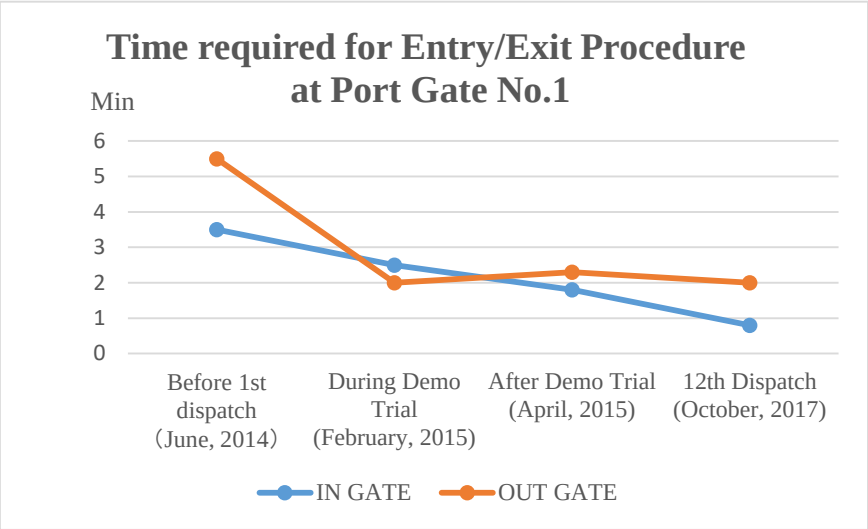


Figure 4-6 Transition of time required for Entry/Exit Procedure at Port Gate No.1

4-3-4. Evaluation of Introduction of Web Portal System and its challenges

The Team conducted the demonstration trial of the Web Portal System using the data collected by the RFID system during the 11th dispatch in addition to the trial conducted during the technical assistance (Part 1). The ChPT Homepage publishes the daily lead time and hourly summary of traffic flow for each site based on the data collected by the RFID system. This lead time is almost identical to the result of the lead time survey conducted by the Team (refer to (2) above) and it is collected on a 24/7 basis. Therefore, it can be used as the Key Performance Indicator (KPI) for the traffic congestion and is one of the best information to be published on the Web Portal System. The following figure (which was generated from the information published on ChPT's homepage) shows the weekly variation of the lead time from CFS to Port Gate No.1 and the number of incoming trailers at Port Gate No.1 and the histogram of the lead time from CFS to Port Gate No.1 on a particular day.

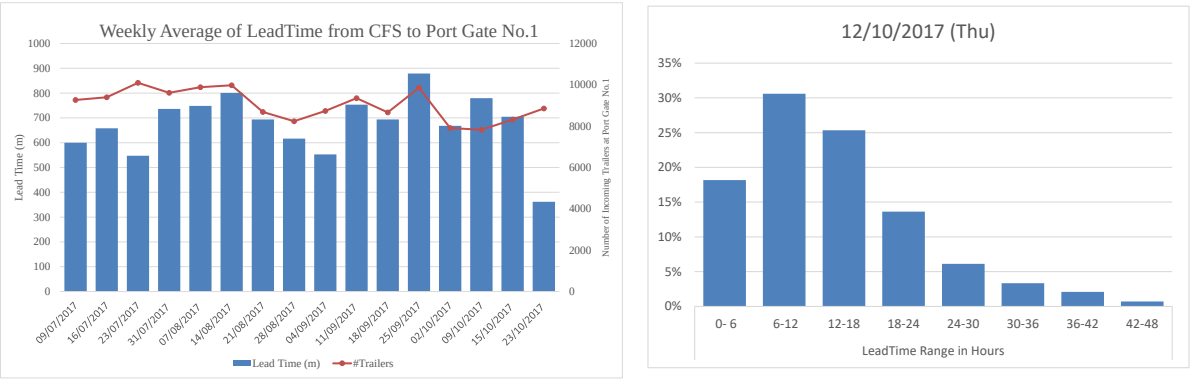


Figure 4-7 Weekly Variation of the Lead Time and Number of incoming Trailers / Histogram of Lead Time on a Particular Day

The demonstration trial of the Web Portal System was conducted aiming at spreading the importance of sharing information on traffic congestion among stakeholders. As a result, it was effective not only for achieving the above aim but also for selecting the information to be shared. Furthermore, it was

confirmed through the trial that there is no technical issue for introducing the full-fledged Web Portal System.

It is recommended that ChPT establish a sustainable system and utilize the traffic congestion information continuously, which is shared among stakeholders, in order to alleviate the traffic congestion.

4-4. Recommendations toward the Next Step

4-4-1. Continuous observation and survey on congestion status

Congestion is a complicated phenomenon. In order to propose and implement effective measures to reduce congestion, continuous observation and survey on congestion are essential to understand the underlying causes of congestion.

The Team has conducted a variety of observations and surveys inside/outside the port to grasp the congestion phenomenon. The following table shows a part of observations and surveys conducted by the Team.

Table 4-3 Example of Observations and Surveys conducted by the Team

Site	Content
Outside the Port	Continuous survey on the number of queuing trailers
	Continuous observation on the congestion status
Port Gate No.1	Observation on entry/exit procedures
	Survey on processing time
	Survey on lead time
Inside the Port	Continuous survey on the number of parked trailers
	Continuous observation on congestion status
	Observation on trailer flow at terminal in-gate
	Survey on processing time at terminal in-gate

By conducting the above observations and surveys, the Team was able to understand some of the causes of congestion which aided us in proposing measures to alleviate congestion.

Therefore, ChPT should conduct necessary observation and survey on congestion in collaboration with concerned organizations and stakeholders in order to grasp the congestion status and identify appropriate measures for congestion alleviation. As the RFID system has recently begun operation, utilization of data obtained by the system and introduction of a monitoring system with live cameras proposed by the Team may be effective.

4-4-2. Coordinated measures for congestion alleviation

As the traffic congestion is caused by a variety of factors which are interrelated, countermeasures should be examined from several viewpoints and implemented concurrently.

The Team studied the relation between the trailer processing capacity among major points in the trailer flow and the traffic congestion during the technical assistance (Phase I). The results are shown below.

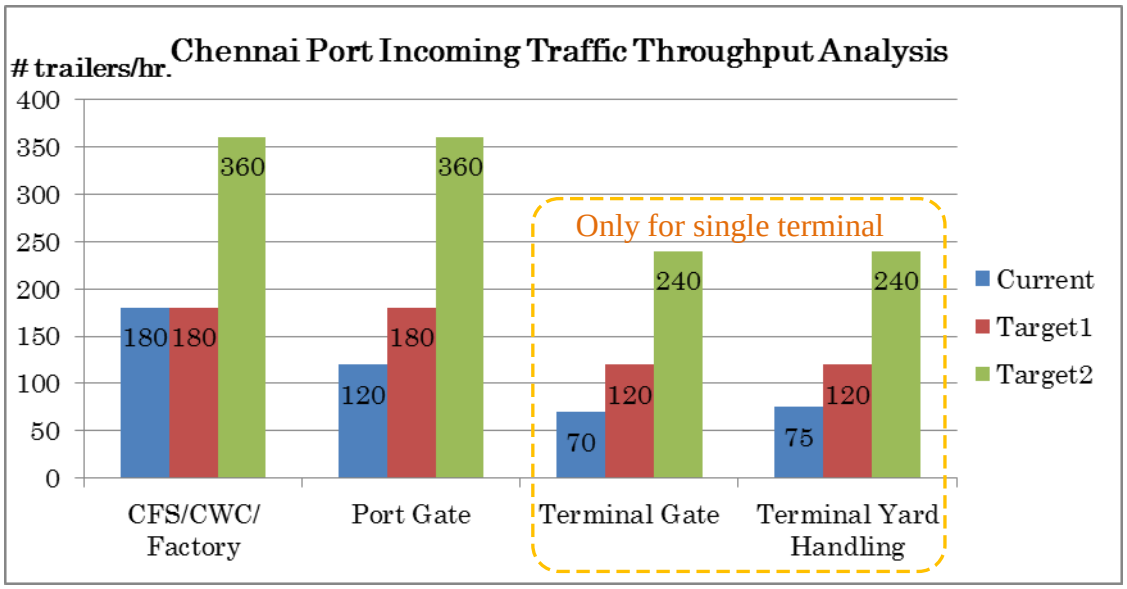


Figure 4-8 Comparison of Processing Capacity among major Points in the Trailer Flow

There is a close relation among the trailer processing capacity at Port Gate No.1, the trailer processing capacity at both terminal gates, and the container handling capacity of the container yard for both terminals. Adopting a simplified model where the capacity of traffic flow only depends on the trailer or container handling capacity at major points in the trailers flow, trailer queue is generated outside the Port if Port Gate No.1 cannot process a sufficient number of trailers, which originate from the CFS, CWC, factories, and inland depot, in a certain unit of time. In the same way, traffic congestion occurs inside the Port if the terminal gates cannot process the number of trailers which go through Port Gate No.1 in a certain unit of time. On the other hand, if heavy traffic congestion occurs inside the Port, the trailer entry process must be stopped at Port Gate No.1; congestion will disappear if the terminal gates accept more trailers than those which go through Port Gate No.1. This is the same in relation between number of trailers processed at the terminal gates and number of containers handled in the yard of the terminals.

Based on the results of daily observations, the Team considers the trailer processing capacity per certain unit of time at Port Gate No.1 is insufficient as a queue is regularly generated outside the Port. Therefore, it is firstly required to improve the trailer processing capacity at Port Gate No.1. This improvement can be realized by increasing the number of lanes for Port entry from 2 to 3 at Port Gate No.1.

As mentioned above, improving the trailer processing capacity may not alleviate the traffic congestion

inside the port unless the trailer processing capacity at terminal gates is improved simultaneously. Therefore, both the trailer processing capacity at the terminal gates and the container handling capacity at the terminal yards have to be improved as well as the trailer processing capacity at Port Gate No.1. However, increasing the number of lanes at the terminals, which would immediately increase capacity, is not easy to implement due to land limitation, and a shortage of Customs officers, etc. On the other hand, improving the container handling capacity may be even more difficult. Therefore, the Team proposes the introduction of a waiting space near the terminal gates together with the improvement measures on the trailer processing capacity at Port Gate No.1 in order to continue the entry process at Port Gate No.1 even if the traffic queue starting from the terminal gates is generated. Although the introduction of the waiting space may not directly reduce the lead time from CFS or factories to the terminals, it will eliminate the traffic congestion inside the Port. The improvement of the entry process at Port Gate No.1. will directly lead to a reduction in the lead time.

In this way, ChPT has to implement countermeasures continuously to solve traffic congestion issues based on regular observation and by examining the relations among each issue

4-4-3. Establishment of sustainable system

The congestion phenomenon occurring inside/outside Chennai port is a very complicated phenomenon in which various factors are intertwined. There is no single measure which can magically resolve congestion issues in a short period of time. Congestion is a phenomenon which involves many organizations and stakeholders. Therefore, such organizations and stakeholders need to coordinate and cooperate with each other and make sustained efforts to resolve congestion issues.

Utilization of the PDCA (Plan-Do-Check-Act) cycle which entails “observing and grasping the phenomenon (in this case ‘congestion’), preparing and implementing measures, analyzing and evaluating, and finally improving the measures” in order to tackle congestion issues is an effective method for promoting sustainable efforts. In addition, information sharing among organizations and stakeholders are vital as well.

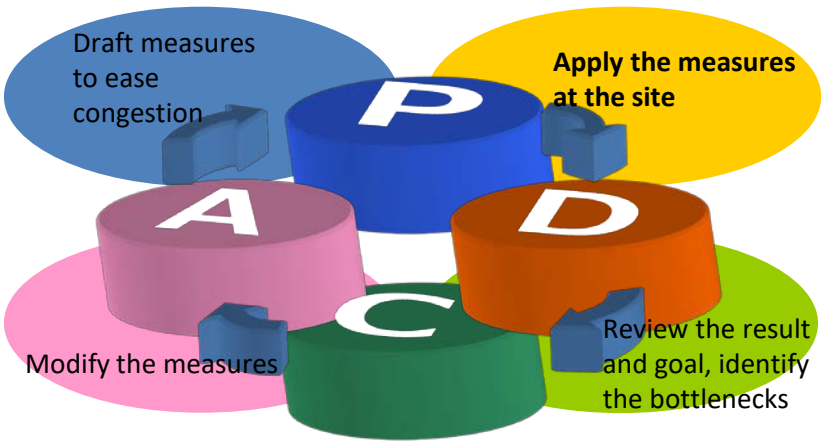


Figure 4-9 PDCA Cycle Method

To do the above, establishment of an effective framework/mechanism will be needed. Organizations and stakeholders could work together and tackle the issues continuously only by establishing such a framework/mechanism.

To support the establishment of such a framework/mechanism, preparation of TOR (Terms of Reference) is required. TOR here means some kind of so-called “guiding principle” which indicates the method to establish and operate the framework/mechanism.

Following TORs have been prepared by the Team. Details are attached in Appendix.

1. (Draft) Running Rules for the Committee for Improvement of Port Operation and Management
2. (Draft) Running Rules for the Working Group for Sustainable Operation of Entry/Exit Control
3. (Draft) Operation Rules in the Waiting Are for Trailers
4. (Draft) Operation Rules for Trailer Entry Process at Terminal In Gate
5. (Draft) General Rules for Port Users on Use of Port