

Republic of India
Chennai Port Trust

The Project On Improvement of Chennai Port Operation

Final Report Summary

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Japan International Cooperation Agency

The Overseas Coastal Area Development Institute of Japan

Mitsui Engineering & Shipbuilding Co., Ltd.

Hakata Port Terminal Co., Ltd.

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List of Abbreviation and Terminology

Abbreviation	Description
B/L	Bill of Lading
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
DO	Delivery Order
DPW	Dubai Port World
DRF	Delivery Request Form
EIR	Equipment Interchange Receipt
FORM 13	FORM 13 ①Export FORM13 ②Import FORM13
HEP	Harbour 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
NHAI	National Highway Authority of India
NHTA	Nagoya Harbor Transport Association
NUTS	Nagoya United Terminal System
OOG	Out Of Gauge (Cargo)
PDCA	Plan-Do-Check-Action
PNR	Public Notification of Regarding
PPP	Public Private Partnership
PSA	Port of Singapore Authority International
RFID	Radio Frequency Identification

RO/RO	Roll On/Roll Off
S/C	Steering Committee
TEU	Twenty Feet Container Equivalent Unit
TOS	Terminal Operating System

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1 Background and Purpose of the Project

1.1 Background of the Project

Chennai port, located in Tamil Nadu State, plays a strategic role in marine transport to the Far East and South East Asia. Japanese firms including automobile manufacturers are investing in Chennai and other cities in Tamil Nadu, contributing to the state's steady economic growth.

There are thirteen major ports in India managed by the Ministry of Shipping (MOS) of the central government. Chennai port, a major port located on the western side of Chennai city, plays an important role as a gateway of physical distribution in Eastern India.

Chennai port is now being converted to a container port. It handled 1,552 thousand TEUs from April 2014 to March 2015, making it the second largest container handling port among major ports next to Jawaharlal Nehru Port (Mumbai, Maharashtra), which handled 4,467 thousand TEUs in the same period (in case of including private ports, Mundra port occupies 2nd place handling 2,720 thousand TEUs in 2014 and Chennai port drops to 3rd place).



Figure 1-1 Overview of Chennai port

On the other hand, Chennai port is suffering from serious congestion caused by container trailers inside and outside the port as shown in the pictures below. The heavy congestion is a result of various factors such as the poor condition of the road network, the tendency of trailer drivers to enter the queue without carrying a proper set of documents, the fact that trailers have to go through three gates to reach the container terminal and that gate transactions are conducted manually and are generally inefficient, etc.

Based on these circumstances, Japan and India signed a Joint Statement on “Vision for the Enhancement of Japan-India Strategic and Global Partnership on the 60th Anniversary of the Establishment of Diplomatic Relations,” aiming to improve infrastructure such as ports, industrial parks and their surrounding facilities in Ennore, Chennai and the adjoining areas.



Picture 1-1 A line of container trailers waiting to enter port gate No1



Picture 1-2 Traffic congestion in front of the terminal gate

Consequently, JICA conducted a study entitled “Data collection survey on the improvement of port operations” (hereinafter referred to as “Data collection survey”) in October and December 2013. Data collection survey revealed the need to improve port operation and port traffic control as well as develop basic infrastructure including port facilities, port road and a parking lot. The Japan Chamber of Commerce and Industry in India, which consists of over 400 Japanese companies located in India, also urged the government of India and the State of Tamil Nadu to take measures to improve operations at Chennai port.

Finally, JICA decided to dispatch experts to assist in improving port operation in Chennai port and in easing the congestion in collaboration with Chennai Port Trust.

1.2 Purpose of the Project

Objective of this project is to make Chennai port user-friendly through the following tasks.

- 1) To enhance the efficiency of Chennai port by reducing container movement lead times etc.
- 2) To enhance the capacity of container operation in Chennai port through technical assistance for introducing an effective port operation and traffic control system

Target area of this project is Chennai port and its surrounding area.

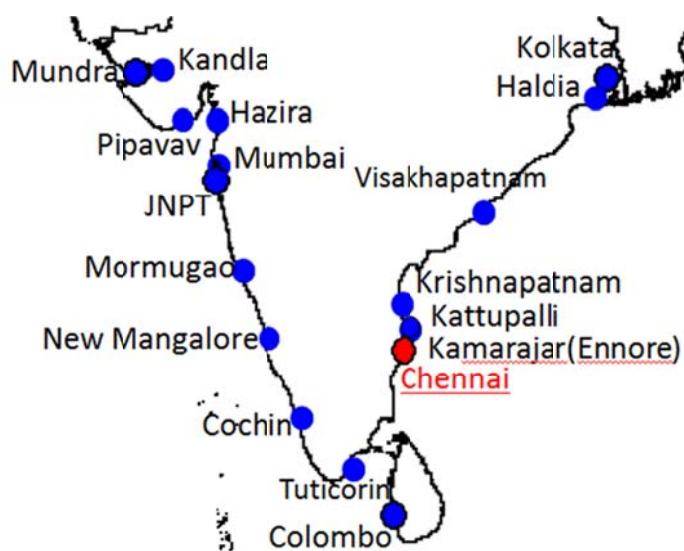


Figure 1-2 Location of Chennai in India

2 Team Members and Dispatch Schedule

The JICA Study Team (hereinafter referred to as “The Team”) members and dispatched schedule from the first dispatch to the eight dispatch are shown below.

(1) Composition of the Team

Assigned Area	Name	Organization
Team Leader / Port Planning	Akira KOYAMA	The Overseas Coastal Area development Institute of Japan (OCDI)
Management and Operation of CFS	Takeshi SUZUKI Makoto MIUTANI Ryuichi KUWAJIMA	OCDI
Port IT System Design (1)	Norihiro FUKAZAWA	Mitsui Engineering & Shipbuilding Co., Ltd.
Port IT System Design (2)	Hiroshi KIMOTO	Hakata Port Terminal Co., Ltd.
Gate Management and Port Traffic Management (1)	Daitoku FUJINO	Hakata Port Terminal Co., Ltd.
Container Traffic Simulation (1)	Makoto MIZUTANI Osamu KUNITA	OCDI
Gate Management and Port Traffic Management (2)	Osamu IGUCHI	OCDI
Container Traffic Simulation (2) / Coordinator	Ken SAITO	OCDI

Note: There are a few names in a name’s column. The lower name is a successor of the upper name.

(2) Dispatch Schedule of The Team for the first year

Dispatch No.	Dispatch Schedule	Number of Experts
First	16 th July 2014 – 14 th August 2014	6
Second	29 th September 2014 – 7 th November 2014	8
Third	18 th January 2015 – 28 th February 2015	8
Fourth	12 th April 2015 – 1 st May 2015	6
Fifth	6 th July 2015 – 4 th August 2015	6
Sixth	29 th September 2015 – 28 th October 2015	8
Seventh	26 th January 2016 – 24 th February 2016	7
Eighth	23 rd May 2016 – 10 th June 2016	5

Note: Dispatch schedule includes travel days to/from Japan.

3 Survey and Study Activities of the Project

Major Activities undertaken during the two-year period of the project are as follows.

3.1 Outline of Project Activities

Activities conducted as part of the Project are outlined in the table below.

	2014		2015				2016		
	07-09	10-12	01-03	04-06	07-09	10-12	01-03	04-06	
No. of Dispatch	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	
Congestion Survey	→								
Demonstration Trial		Preparation		Implementation		Evaluation, Follow-up			
IT Related Measures		Propoasal			Trial		Evaluation		
Masterplan		Proposal of Infrastructure Improvement				Study of Direction			
Other Activities (Simulation, Hearing, Survey of other ports)	→								
S/C	◎	◎	◎◎	◎	◎	◎	◎◎	◎	
W/G	○	○	○			○	○		

3.2 Status of Port Activities

(1) Cargo Handling Trend

Major cargo handled at Chennai Port is shown in the table below.

Table 3-1 Major Cargoes Handled at Chennai Port

(In '000 Tons, '000 TEUs)

Cargo	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 Apr-Jun
P.O.L	12,794	13,112	13,425	13,882	13,295	13,425	12,784	12,736	11,890	3,121
IRON ORE	10,815	8,247	7,882	2,176	97	52	-	146	-	-
Fertilizer	882	761	591	776	633	421	415	541	260	58
Coal	3,990	4,684	3,362	2,503	961	-	-	-	-	-
Container	18,049	20,581	23,476	29,421	30,075	29,708	28,330	29,945	30,210	7,293
Others	10,624	10,106	12,321	12,702	10,646	9,798	9,576	9,173	7,700	2,673
Total (Tons)	57,154	57,491	61,057	61,460	55,707	53,404	51,105	52,541	50,060	13,145
Container (TEUs)	1,020	1,143	1,225	1,523	1,558	1,539	1,468	1,552	1,565	-

Source: 2007-2014; Indian Ports Association, April 2015 -June 2016; ChPT
Supplement: 2007 (April 2007 to March 2008)

(2) Container Handling Trend

The container handling volume in 2011 was 1,579 thousand TEUs, the highest on record, but then decreased to 1,546 thousand TEUs in 2012 and 1,482 thousand TEUs in 2013. However, the container handling volume increased to 1,527 thousand TEUs in 2014 compared to the previous year and remained steady at 1,529 thousand TEUs in 2015. The container handling volume at Chennai port is shown in the table below.

Table 3-2 Container Handling Volume at Chennai Port

DPW+PSA	Import(TEU)		Export(TEU)		Tranship(TEU)	Total(TEU)	
	laden container	empty container	laden container	empty container			
2010	714,802	27,290	481,408	208,646	10,332	1,442,478	
2011	791,200	20,535	674,407	87,013	6,680	1,579,835	
2012	758,460	22,132	554,680	210,472	802	1,546,546	
2013	January	65,616	1,953	45,627	16,543	50	129,789
	February	55,897	2,214	47,038	12,352	116	117,617
	March	57,840	2,500	55,689	9,661	32	125,722
	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
	Total(2013)	722,143	31,308	593,683	134,996	282	1,482,412
2014	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
	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
	Total(2014)	735,421	54,601	625,261	111,776	611	1,527,670
2015	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
	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
	Total(2015)	756,690	56,613	564,006	148,232	4,015	1,529,556
2016	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
	April	65,544	4,164	40,729	14,111	40	124,588
	May	66,602	2,869	33,366	16,301	0	119,138
	Total(2016)	325,246	18,344	219,821	74,370	43	637,824

Source: 2010 – March 2013; Data Collection Survey 2013 JICA, April 2013 – May 2016; ChPT

As for the share between two terminals, DPW handled 52.6% and PSA handled 47.4% in 2014 while DPW handled 56.3% and PSA handled 43.7% in 2015. Thus, the share of DPW is increased from 2014 to 2015. However, during the period from January to May 2016 PSA's share increased to 51.4% while DPW handled 48.6%.

(3) Trends of Calling Vessels

The Team studied the changes of calling vessels at Chennai port.

The Team studied the details of the changes in container vessels calling at two terminals during the 8th dispatch as below.

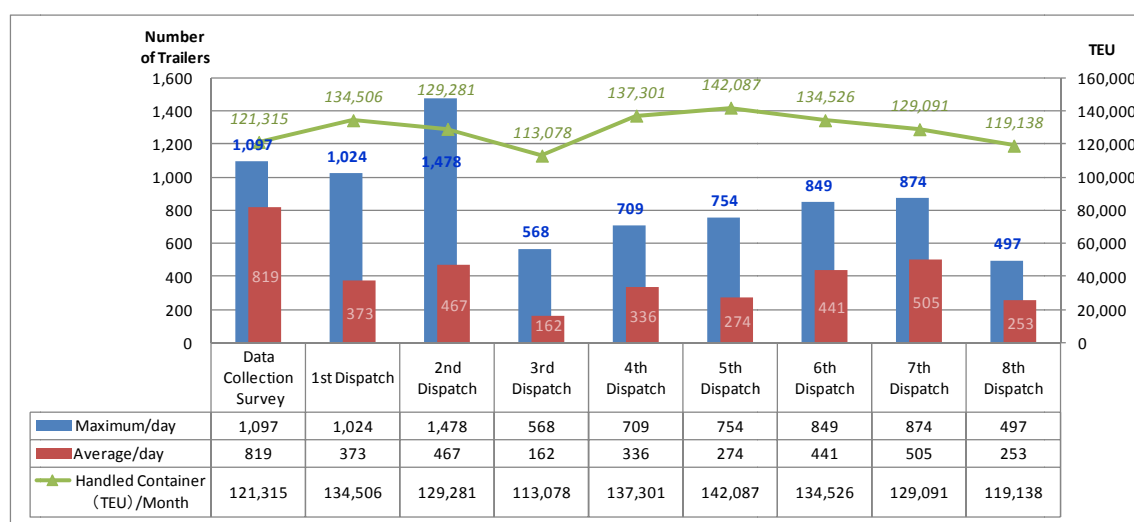
Based on the information from a shipping line and ChPT, some calling vessels which used to use the DPW terminal switched to the PSA terminal following the realignment of ACS. Moreover, feeder suspended its service at the DPW terminal. These changes occurred in early 2016. Consequently, it is thought that the container handling volume at DPW was decreased while that at PSA was increased.

3.3 Status of Congestion

(1) Regular Observation of Traffic Congestion

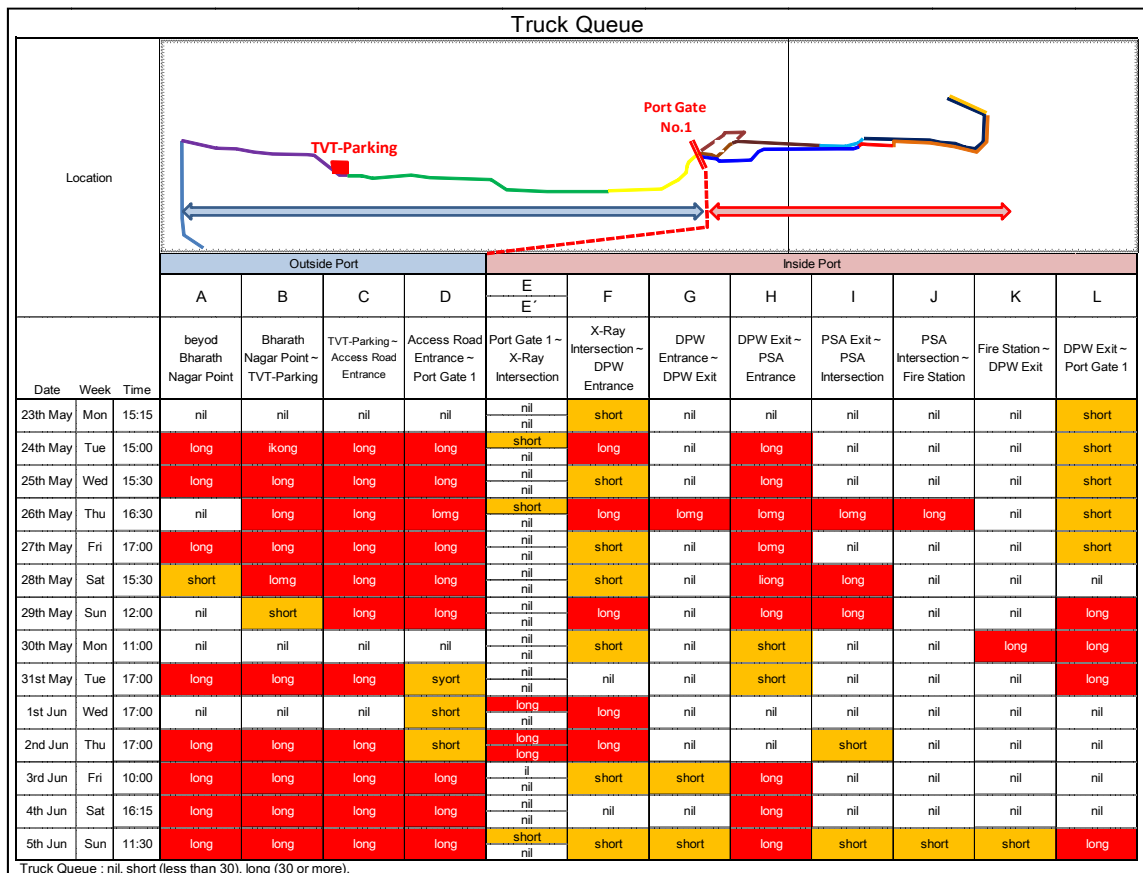
The Team regularly observed the traffic congestion status and examined the characteristics of the congestion at each dispatch. As part of its observation works, the Team counted the number of queuing trailers outside the port, observed the end of the queue, and confirmed congestion status inside the port from the flyover where inside the port can be viewed, etc. The figure below shows the number of queuing trailers outside the Port during the period from the 1st dispatch to the 8th dispatch and the period of the data collection survey (December 2013).

Table 3-3 Number of Queuing Trailers Outside the Port



The maximum number of queuing trailers was more than 1,000 during the period of the data collection survey to the 2nd dispatch but no long queues have been observed since then. It is thought to be due to efforts of the Study Team to analyze traffic congestion and share information on the congestion status with shareholders through the S/C and so on. The demonstration trials may have also motivated stakeholders to make efforts to reduce congestion. For example, ChPT started to implement measures to ease congestion in cooperation with the private sector while the State of Tamil Nadu improved the access road through road expansion works.

According to the results of the surveys on the degree of traffic congestion outside Chennai Port, the queuing trailers inside the port starts from either DPW IN Gate, PSA IN Gate, or Port Gate No.1 (Exit). (red color indicates queues of more than 30 trailers and orange color indicates queues less than 30 trailers). The queue starting from DPW IN Gate frequently occurred during a period from the 3rd dispatch to the 7th dispatch, but congestion was significantly reduced during the 8th dispatch.



**Figure 3-1 Congestion Status inside outside the Port
(8th dispatch: 23 May to 5 June 2016)**

(2) Survey on Traffic Congestion Status

The Team conducted a various surveys other than the regular observation of traffic congestion described in 3.3 (1). These surveys aimed at grasping the status of the traffic congestion and examining measures for alleviating the congestion. The overview and results of the major surveys are described below.

1) Survey on Processing Time at Port Gate No.1

The Team conducted the survey on the processing time at Port Gate No.1 for outgoing trailers during the 3rd dispatch.

2) Survey on Trailers Passing through Gates

The Team conducted the survey on trailers passing through Port Gate No.1 and terminal gates in order to grasp the processing capacity at each gate.

3) Survey on Documents carried by Trailer Drivers

a. Harbor Entry Permit

The Team conducted interviews with trailer drivers of both import and export container vehicles at Port Gate No.1 (IN) to determine if they were carrying the proper documents. The following figures show the results of the surveys conducted at the data collection survey and at the 1st, 2nd, and 6th dispatch.

b. Sticker

According to the interview survey, sticker possession ratio of drivers was 60% (1st dispatch), but rose to 88% (2nd dispatch) two months later.

The stickers are no longer used as trailer driver's document possession ratio was improved.

4) Survey inside the Port

a. Survey on Parked Trailers

The Team conducted interviews with trailer drivers at Port Gate No.1 (OUT) at the 1st dispatch on their entering time to the Port and calculated their staying time inside the Port. In addition, the Team interviewed trailer drivers on their staying time inside the Port, double transactions¹ and parking place during the 2nd dispatch.

b. Survey on Traffic Congestion

The Team conducted a survey on the number of queuing trailers inside the Port for 24 hours every two hours from 27 October to 3 November 2014.

c. Study on the Flow of Trailers using Monitoring Camera at Terminal IN Gate

The Team monitored incoming trailers to container terminal gates continuously by setting a fixed point camera around IN Gates of both DPW and PSA terminals during the 6th and 7th dispatch.

d. Survey on Gate Processing Efficiency

The Team conducted site observation on the operational status of container inspection, document check procedure, etc. in front of terminal IN Gates in addition to the observation by fixed point camera during the 6th and 7th dispatch. The result shows that while Idling Time has been reduced, the reception time has increased in both terminals. The reduction in the Idling Time is indicative of the smoother trailer flow

5) Outside the Port Survey

a. CWC/CFS Survey

The Team counted the number of departing trailers headed to Port Gate No.1 each hour at CWC/CFS from 17 to 18 October 2014. The Team also interviewed trailer drivers on staying time, stuffing place and expiry date of Form 13 at CWC/CFS.

b. Transportation Time from CFS to Port Gate No.1

The Team interviewed trailer drivers about transportation time from departure (CWC, CFS, etc.) to Port Gate No.1 (IN) during the 2nd, 7th, and 8th dispatch.

¹ A trailer sometimes carries an import container out just after delivering an export container from/to container terminals.

The transportation time from departure (CFS, etc.) to Port Gate No.1 was shortened to 15 hours during the 8th dispatch, as compared to 18 or 19 hours during the 7th dispatch and 28 hours or 40 hours during the 2nd dispatch. The alleviation of traffic congestion is steadily in progress in terms of transportation time.

(3) Activities of the Task Force Team

ChPT set up the Task Force Team which consists of Terminal Operators, Trailer Owners Association etc. on 18 January 2016. According to interviews with concerned persons, its activities are described below.

1) Traffic Control Outside the Port

Staff members from the Trailer Owners Association control the trailer queue outside the Port. Thirty staff members take turns working a 12- hour shift and do such jobs as confirming the trailer queue to a single lane, instructing trailers to stop and go, while communicating with colleagues by cell phones and monitoring area on motorbikes. They control the traffic flow to the Port Gate when congestion occurs.

2) Advanced Carried Document Check

ChPT, Terminal Operators and Security Firm (which is entrusted by ChPT) are performing the document check of trailer drivers in advance around the entrance of the access road to Port Gate No.1. One team consists of 4 persons and they work in 8 hour shifts around the clock. They confirm if trailer drivers with container have Form 13, Shipping Bill, Gate Pass and their validity. Drivers who do not possess the necessary documents are not allowed to proceed to the Port Gate No.1 and must park along the left side of the road.

However, trailer drivers without containers were not subject to a document check (due to opposition from certain drivers). Some driver suggested that such insufficient document checks were not contributing to congestion inside the port and that a document check for all drivers should be conducted.

The activities of task force team outside the Port were discontinued during the 8th dispatch. According to the interview of persons involved, this was because the traffic congestion was being reduced. It was confirmed that the queued trailers outside the Port were aligned as never before and that the number of trailer queue had decreased. On the other hand, their activities inside the Port continued. Traffic control persons of the task force team controlled the traffic whenever congestion occurred or when trailers were not aligned with a lane.

3.4 Implementation of Demonstration Trials and Follow-up Activities

As previously stated on the status quo of traffic congestion outside the port, the Team conducted four demonstration trials as advanced measures based on the traffic survey results in order to evaluate the effect of measures for alleviating the congestion. The trials were conducted for one week from 9 February 2015 (Monday) to 15 February 2015 (Friday). The results and evaluation of the demonstration trials and succeeding following up survey are summarized below.

(1) Demonstration Trial 1: Simplification of the procedure at Port Gate No.1

1) Outline and follow-up status

The aim of demonstration trial 1 is to replace the current hand-written log book with electrical recording by reading a barcode printed on the HEP.

The system developed for demonstration trial 1 was discontinued in August 2015 due to repeated hardware failure and a lack of a sustainable system for continuous operation. Therefore, the Team prepared the recommendation on Implementing Port Entry/Exit Control System based on the experience in the trial and the succeeding 6 months of operation. The recommendation includes running rules for working group for sustainable operation, setting up emergency contact plan, system expansion plan for re-starting the bar code reading system, etc.

2) Evaluation

- a. The processing time at Port Gate No.1 has been largely reduced. This is mainly due to the introduction of the bar code reading system, though the several procedural changes introduced by the CISF, Customs, etc. have contributed as well.
- b. Although the bar code reading system was discontinued, Port Entry/Exit Control is being conducted by recently introduced RFID system. The knowledge obtained through the implementation of the barcode reading system and the recommendation prepared by the Team on the establishment of a sustainable system can also be applied to the new system.

(2) Demonstration Trial 2: Utilization of TVT-Parking

1) Outline and follow-up status

All trailers applying for HEP have to enter TVT-Parking. Traffic police stationed in front of TVT-Parking will guide trailer drivers back to Route 114.

The utilization of TVT-Parking was not effective for alleviating the congestion during the implementation of demonstration trial in February, 2015 and after that. The Team confirmed that trailers were unable to enter the gate and wait there for HEP issuance or the proper documents. However, trailer drivers were able to enter and the issuance of HEP was in operation.

2) Evaluation

- a. Demo 2 was not implemented in accordance with Scope of Demonstration Trial of Demo 2, although the document was prepared in advance in order to clarify the procedure at TVT-Parking and request that drivers be notified and a notice board be prepared etc. However, the scope of Demo 2 was not shared among trailer drivers, traffic police and Pass Section persons, and the period of the trial was too short to rectify the situation.
- b. One of the outcomes of the trial was learning that the most of the HEP applicants were not trailer drivers and confirming the necessity of the HEP issuance place. It also helped ChPT recognized the

importance of cooperation with external organizations.

- c. TVT-Parking plays an important function in issuing HEP. The issuance of HEP at TVT-Parking should continue because it is very convenient for users as it is open for 24 hours while the central pass section office is open only during the daytime.
- d. The Team expects that the usage of TVT-Parking as export CFS by CWC will contribute to alleviating the traffic congestion.

(3) Demonstration Trial 3: Restriction of Parking on Internal Roads

1) Outline and follow-up status

The aim of Demonstration trial 3 was as follows.

- a. To designate No Parking Road.
- b. To allocate Road Management Person in order to order drivers to move their trailers, to put stickers on parking trailers without drivers and to report vehicle numbers of parking trailers to ChPT

The Team has conducted the follow-up surveys continually after the demonstration trial by counting the number of parked trailers along the roads and waiting areas inside the Port.

2) Evaluation

- a. Number of parked trailers at the entrance route was decreasing after the 5th dispatch, even though the 'No Parking' rule was not followed on the No Parking Roads. On the other hand, many parked trailers were still observed at the exit route.
- b. The number of parked trailers both at the entrance route and the exit route increased in the 6th and 7th dispatch. However, the number of parked trailers had decreased in the 8th dispatch. The parked trailers did not seem to severely impede traffic.
- c. An increase of trailers waiting in the 4 waiting areas, which were set up by ChPT after the demonstration trial, was not observed. This is because number of waiting trailers has been decreasing since the 7th dispatch thanks to the road maintenance work inside the Port, such as road widening, lane separation by concrete curb, etc.
- d. The following measures shall be implemented in order to reduce the parked trailers inside the Port.
 - i) Traffic control activities inside the Port and guiding of trailers to the waiting area by the task force team should be continued.
 - ii) Parking should be strictly prohibited from the DPW Entrance to the Port Gate No.1, so that separate trailer queues (i.e., 2 lanes) can be maintained for DPW and PSA and that trailers queues will not reach the Port Gate No.1.
 - iii) Parking along the Periphery Road should be strictly prohibited to facilitate the exit of trucks.
 - iv) Trucks parked for an excessive period of time should be subject to a penalty, such as a fine or no-reissuing of HEP.

- v) Infrastructure development inside the Port such as road widening, waiting area enhancement, etc. shall be further promoted.

(4) Demonstration Trials 4: Allocation of Traffic Control Persons in Port Area

1) Outline and follow-up status

Demonstration trial 4 was implemented as follows.

X-Ray Intersection

- a. Introduction of Traffic Flow Regulation.
 - i) No Vehicles may stay in the Regulated Traffic Area.
 - ii) Vehicles to/from X-Ray Screening Center have priority.
- b. Allocate 2 Traffic Control Persons

DPW Intersection

- a. Introduce Traffic Flow Regulation
 - i) No Vehicles may stay in the Regulated Traffic Area.
 - ii) Vehicles from DPW and PSA should move alternately.
- b. Allocate 2 Traffic Control Persons.

The Team has continually confirmed the status on allocation of traffic control persons and implementation of traffic regulation at the intersections after the demonstration trial.

2) Evaluation

X-Ray Intersection

- a. Traffic Flow Regulations were not followed during the demonstration trial. Trailers staying in the Regulated Traffic Area were observed which sometimes prevented trailers from entering the X-Ray Screening Center.
- b. Traffic Flow Regulations were followed even when traffic control persons were not present, although parked/stopped trailers within the intersections were still observed up to 7th dispatch.
- c. The following measures are required in order to keep the smooth traffic flow at the intersections.
 - i) To monitor the X-Ray Intersection by using outdoor cameras
 - ii) To allocate traffic control persons whenever the traffic congestion occurs.

DPW Intersection

- a. Traffic Flow Regulations including moving vehicles from DPW and PSA alternately were not followed during congested periods which prevented trailers from DPW from exiting.
- b. Traffic Flow Regulation was followed to some extent after the demonstration trials and trailers were guided to go out from the DPW Exit by a traffic control person at congested times.
- c. The following measures should continue to be implemented
 - i) To allocate traffic control persons whenever the traffic congestion occurs.
 - ii) To clearly indicate no parking/stopping rules by marking white line on the road.

3.5 Effects of Measures by Simulation Model

The Team used a simulation model to illustrate the effects of Demonstration Trials (Demo1, 3 and 4) at the Steering Committee on 23rd February 2015.

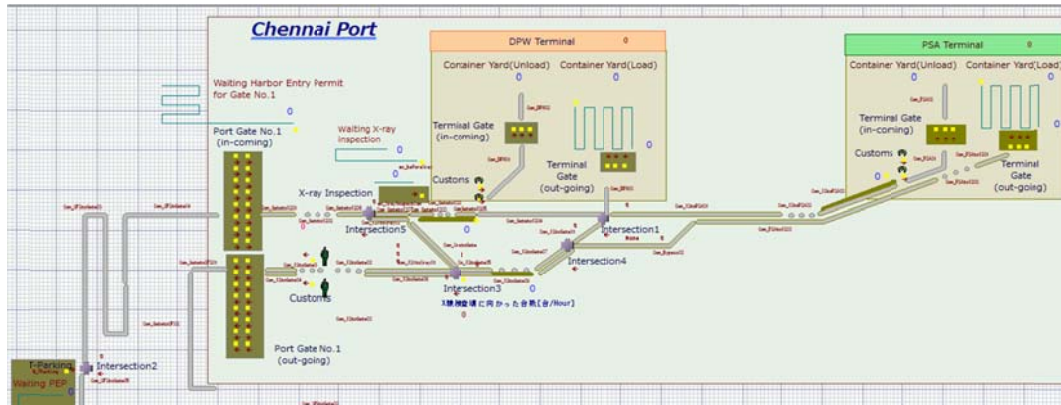


Figure 3-2 Simulation Model for the 3rd Dispatch

(1) Feedback Demonstration Trials to Simulation Model

a. Demo1 (Simplification of Gate Procedures at Port Gate No.1)

The aim of Demo1 was to reduce gate procedure time at Port Gate No.1. Simulation model demonstrated that gate procedure time was shortened in Demo1.

b. Demo3 (Restriction of Parking on Internal Roads)

The aim of Demo3 was to ease traffic congestion bound for Port Gate No.1(OUT) at the Periphery Road. The simulation model demonstrated the effectiveness of Demo3.

c. Demo4 (Allocation of Traffic Control Person in Port Area)

The aim of Demo4 was to ease traffic congestion by ensuring that vehicles from different lanes take turns entering the intersection. The simulation model reflected the results of Demo4.

The simulation model was not able to reflect the results of Demo2.

1) Current Situation

Traffic congestion occurred at Port Gate No.1 (IN, OUT) and in front of the PSA terminal entrance. Total waiting time for traffic congestion and gate procedure time was 4.3 hours on average.

2) Demo1

Although the traffic queue did not occur at Port Gate No.1 (IN), vehicles remained inside the Port a long time. Total waiting time was 3.2 hours on average (1.1 hours less than the current situation).

3) Demo3,4

Although traffic congestion cleared up along the Periphery Road and the intersection, vehicles waited a long time at Port Gate No.1(IN, OUT). Total waiting time was 3.8 hours on average (0.5 hours less than the current situation).

4) Demo1, 3, 4

In the case of conducting Demo1, 3 and 4 at the same time, trailers entered Port Gate No.1 smoothly and the traffic congestion inside the Port was reduced. However, traffic congestion occurred at the Customs Gate in front of Port Gate No.1 (OUT). Total waiting time was 3.1 hours on average (1.2 hours less than the current situation).

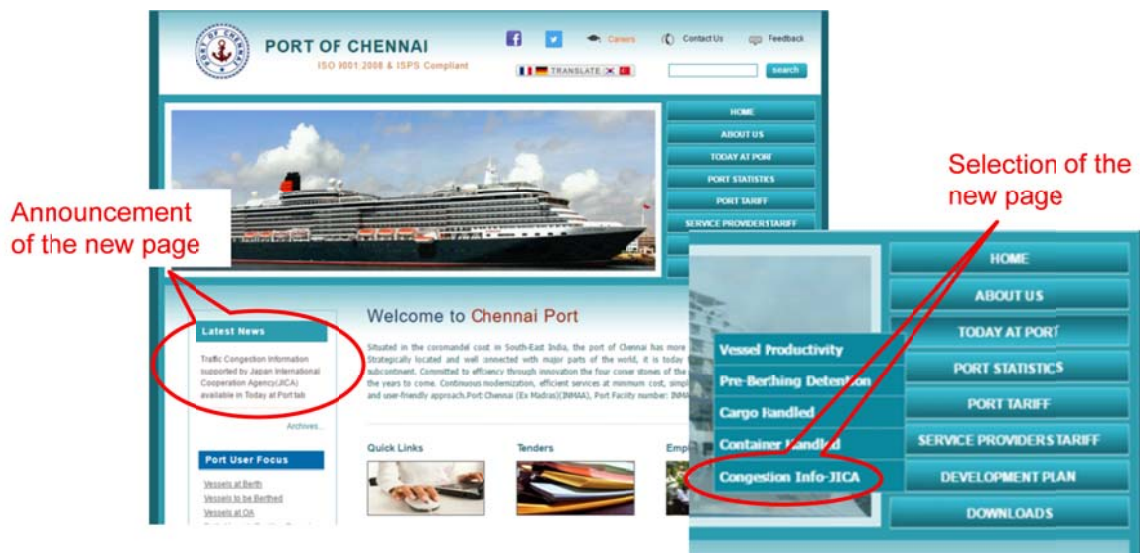
3.6 Implementation of IT Related Measures

The Team has studied the implementation of IT systems as one of the measures for alleviating the traffic congestion.

(1) Web Portal System for sharing information related to traffic congestion

The system aims at providing more effective information for stakeholders in order to alleviate traffic congestion. The information to be shared among stakeholders includes traffic congestion status at various places. A live picture of the congested road, real-time summary of trailers passing through several gates, etc. will be available. Vessel schedule information, issuing status of FORM13, DRF, etc. can also be accessed.

The Team exchanged the MOU on implementation of demonstration trial of Web Portal System with ChPT during the 6th dispatch. The trial is for publishing the information related the traffic congestion on the existing ChPT Homepage. The trial was implemented during the 7th and 8th dispatch based on the MOU with the cooperation of ChPT and CISEF. The following figure shows the ChPT Homepage and the additional pages.



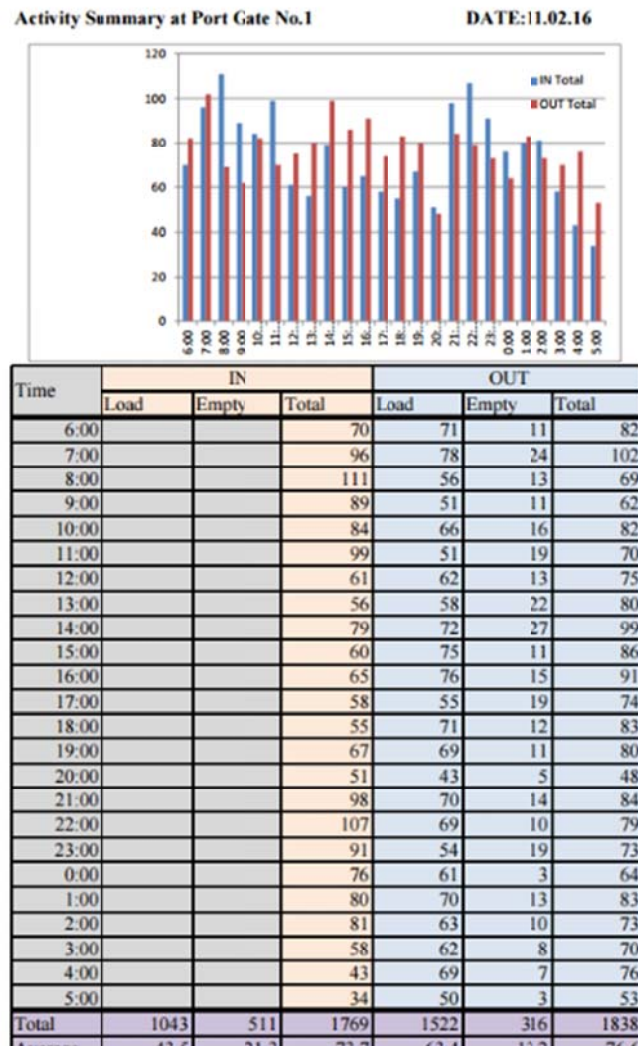


Figure 3-4 Modification to the ChPT Homepage

(2) **Proposal of Entry/Exit Control System for the Port**

The Team proposed a Port Entry/Exit Control System at Port Gate No.1 to enhance the flow of trailers inside the Port. Initially, the Team proposed the barcode reading system but later opted for an RFID based Entry/Exit Control System after learning that such a system was planned to be implemented.

3.7 Examination of Efficient Process of Trailer Flow Inside the Port

The Team has conducted the following activities in order to enhance the flow of trailers inside and outside the Port.

(1) **Examination of Operation Flow**

The Team conducted surveys inside and outside the port including interviews with ChPT, CISF, Customs, CFS and container terminals in order to grasp the operation flow. The results were summarized in the Document Check Flow, which describes the documentation required and procedures between CFS, Port

Gate, and terminal gates.

(2) Survey on Processing Time at Port Gate No.1

a. Incoming Trailers to the Port

The Team calculated the processing time for incoming trailers to the Port using the number of trailers passing through the gate as the documentation check is only conducted at a single window of CISF..

b. Outgoing Trailers from the Port

The Team conducted the survey on the processing time for outgoing trailers from the Port as the documentation check is conducted at multiple windows by CISF and Customs. The survey is conducted during the 3rd dispatch for 2 days and the processing times for 400 trailers were collected.

(3) Survey on Number of Trailers Passing Through Gates

The Team conducted a survey on the number of trailers passing through Port Gate No.1 and terminal gate for each hour.

The data at Port Gate No.1 is summarized from the data collected by the demonstration trial 1 (barcode reading system) and the daily summary manually prepared by the CISF.

As for terminal gates, the Team conducted the survey on actual number of trailers passing through terminal gates for three days during the 4th dispatch.

The Team requested both terminals to submit the statistical data of trailers entering/exiting for one week during 6th dispatch in order to collect the data covering longer period of time. The data obtained has been summarized. However, data was not submitted by the PSA terminal.

(4) Survey around Container Terminals

The Team conducted the following survey around container terminals during the 6th and 7th dispatch based on the request from ChPT. As a result, the Team identified instance of ‘Suspension’ and ‘Idling Time’, which reduce terminal gate efficiency. Based on these findings, the Team proposed operational rules for the entry process at terminal IN Gates during the 8th dispatch.

a. Study on the Flow of Trailers using Monitoring Camera at Terminal IN Gates

A monitoring camera is a useful tool for grasping the operational status of the terminal IN Gate and examining the causes and countermeasures of traffic congestion in front of terminal gates. For this reason, the Team has monitored incoming trailers to container terminal gates continuously for a week including at night and on holidays by setting a fixed point camera around IN Gates of both DPW and PSA terminals during the 6th and 7th dispatch². The Team has analysed the flow of trailers using the pictures which were taken continuously in 30 second intervals during the survey period. The Team has confirmed the existence of suspension time, which is defined as a stoppage in trailer movement for more than 20 minutes. Gate

² The camera was installed only at DPW terminal in the 7th dispatch to determine if there were any changes in the situation.

operation was evaluated by identifying and measuring the suspension time during the period.

b. Survey on the Gate Process Performance

The Team considered the possibility that the bottleneck of the incoming trailer flow originated at the container terminal gates. Therefore, the Team conducted a survey around the terminal gates during the 6th and 7th dispatch in order to find out the reasons for the traffic congestion.

During the site observation, the Team often observed that the above works had not been conducted smoothly. Namely, there were times when no trailer proceeded to the terminal gate windows even if it was vacant and many trailers were waiting behind. The Team refers to such times, when no work is conducted, as “Idling Time” and reported its ratio against the total time to pass through a terminal gate at the S/C. The Team considers that some measures for reducing the ‘Idling Time’ will be required as the average ‘Idling Time’ accounted for from 16% to 37% of the total reception time.

c. Study on the Trailer Process Inside Terminals

The Team has conducted a survey on the container handling status in the yard as for container receiving and delivery in order to enhance the processing of trailers at container terminals. The following surveys were conducted for both DPW and PSA terminals since the 6th dispatch.

- a. Interviews on yard operation
- b. Collection of statistical reports from container terminals
- c. Site observation

3.8 Study on the Direction of the Master Plan

During the 1st to 5th dispatch, the Team collected information related to the activities of Chennai Port. Based on the information collected, the Team made proposals to alleviate the traffic congestion which included the improvement of port infrastructure. During the 6th to 8th dispatch, the Team conducted further observation, and exchanged views with ChPT on the direction of the master plan.

In the 7th dispatch, the current land use plan inside the port, and the situation of the roads and railways were confirmed. Workshops were held twice in which important issues related to the master plan study were discussed and projects that will enhance the efficiency of the port were proposed.

The main points discussed at the workshops were as follows.

- 1) Meeting the cargo demand and role-sharing among ports
- 2) Coping with the increasing size of container ships
- 3) Development of roads and waiting areas for trailers.
- 4) More utilization of IT, i.e. information service to the drivers via Internet
- 5) Better Connection to the hinterland of the port
- 6) Promotion of railway use
- 7) Review of land use
- 8) Environmental improvement and sustainable development

In the 8th dispatch, a workshop on the master plan was also held in which the following issues were discussed.

- Necessity of deepening berths of the DPW terminal
- Necessity of upgrading the access road
- Sharing of cargo among Kattupalli, Kamarajar, Krishnaopatnam, and Chennai
- Necessity of infrastructure development and funding methods
- Necessity of deepening the Jawahar Dock and widening the entrance

In response to the strong request of the president of ChPT, the Team examined the widening of the entrance of the Jawahar Dock. ChPT requested JICA to continue technical assistance and conduct feasibility studies on the projects proposed by the Team.

3.9 Improvement of Synergy on the Operation of Regulatory Authorities Concerned

The Team has strongly recommended strengthening further coordination among stakeholders, specifically coordination with regulatory authorities of the state government such as the traffic police section and the road department to tackle congestion issues effectively. The establishment of an enlarged steering committee is deemed necessary for sustainable improvement in the operations of Chennai port, and a draft running rule for the enlarged steering committee has been prepared.

A task force was formed at the initiative of ChPT to tackle congestion issues. It consists of ChPT, Trailers Owners Association, Terminal Operators and CFS association etc.

As these activities are meaningful not only for congestion alleviation but also for improvement of the port operation as a whole, such activities need to be continued.

Furthermore, the Team would again like to emphasize that the state government, specifically, the traffic police and the road department, needs to become more involved in issues related to congestion

3.10 Related Information

(1) Introduction of a Sticker System

From 15 August 2015, all laden container trailers from CWC & CFS have not been permitted into the Port without appropriate stickers (Refer to the pictures below). All the laden container trailers exiting from CWC/CFSs are provided with stickers without fail after checking all relevant documents.

This means that a trailer which has the sticker is also carrying the proper documents. This sticker system was started when the screening centre operation at the TVT parking was discontinued. The purpose is to increase the number of trailer drivers carrying the proper documents. The sticker possession rate was improved from 80% to nearly 90% according to the survey conducted during the 2nd dispatch, which means that the percentage of drivers carrying the proper documents has increased as well. However, the sticker system was not properly explained to drivers as many were unsure where stickers were checked or collected and as a result we were gradually seeing fewer containers with stickers and did not see them at all lately.

(2) Study on Introduction of RFID System

The Team has been studying the details of the implementation plan and its status of the RFID (Radio Frequency Identifier) system after confirming that ChPT had the plan to implement it to expedite gate procedures. The RFID system consists of the following 3 sub-systems. System 1 and System 2 are now being implemented concurrently and System 3 will be implemented in few years later.

a. System 1

The reception procedure at a terminal gate is speeded up and the information on CFS departure and the one on terminal arrival are recorded automatically

b. System 2

The reception procedure of a trailer at Port Gate No.1 is speeded up and Port entry/exit information for a trailer is recorded automatically

c. System 3

The reception procedure of a personnel at Port Gate No.1 is speeded up and the Port entry/exit information for a personnel is recorded automatically. Harbor Entry Permit (HEP) will be replaced by RFID card.

The system verification test for both System 1 and 2 was completed at the end of 2015; all that remained was to install the hardware equipment for each gate and attach RFID tags on trailers. However, the system has not yet in operation mainly because only 5% of trailers currently have RFID tags. On the other hand, hardware has been installed at major CFSs, Port Gate No.1, and DPW/PSA terminals.

(3) Interviews with Japanese Companies

The Team, in cooperation with JETRO Chennai, conducted interviews with several Japanese Companies (including forwarders, shipping lines, etc.) in Chennai and Bangaluru which usually use Chennai port on the subject of congestion and transit time (lead time) during the 8th dispatch.

Almost all the companies have noticed both an improvement in the level of congestion and a reduction in transit time became 16-20 hours from 3days as before, which is similar to the result of the Team's survey.

(4) Survey at Other Major Ports

The Team conducted a field survey and held a hearing on congestion issues at Jawaharlal Nehru Port (also known as Nhava Sheva Port), the largest container port in India during the 2nd dispatch. Two officials from Chennai Port Trust accompanied the Team. The Team visited the following organizations:

- i) Jawaharlal Nehru Port Trust
- ii) Gateway Terminal India Pvt. Ltd.
- iii) NYK Line (India) Ltd.

Jawaharlal Nehru Port, located 70km from Mumbai, is a dedicated container port consisting of 3 container terminals: Gateway Terminal India, Jawaharlal Nehru Port Container Terminal, and Nhava Sheva

International Container Terminal.

Major findings of the survey and hearing were as follows:

- i) Heavy congestion was observed toward port gates just like the Port of Chennai. However, the congestion might not affect residents since few residential buildings are observed alongside the roads.
- ii) The Port had three port gates, one in each container terminal. The lane of the roads toward each port gate was separated for about 1 km.
- iii) Security check procedure is more simplified and computerized than that in the Port of Chennai. For example, it is not necessary to obtain a HEP (Harbour Entry Permit) before entering the Port.
- iv) Measures for alleviating congestion such as the construction of a by-pass road, the allocation of pre-examination space, and traffic control by the police have been taken.
- v) Customs do not carry out a physical inspection of export containers at the port gate (IN).
- vi) X-Ray scanning of randomly selected import containers as per Customs RMS (Risk Management System) is conducted before exiting from each terminal.

Circumstances in and around the port, such as container throughput, the layout of roads and other port facilities, and land use around the port, etc. are different between the Port of Chennai and Jawaharlal Nehru Port. However, the following congestion alleviation measures taken at Jawaharlal Nehru Port should be considered at the Port of Chennai:

- i) lane separation on the roads toward the gates
- ii) pre-screening by Customs
- iii) allocation of pre-examination space
- iv) simplification of gate procedures

3.11 Additional Technical Assistance Issues

Initially, technical assistance issues for the project on improvement of Chennai port operation were as follows:

- Traffic Normalization with CFS Cooperation
- Efficient Inspection at Port Gate No.1
- Introduction of Traffic Regulation
- Introduction of Portal Web System
- Introduction of Authenticate Gate System
- Draft Long Term Port Facility Plan
- Establishment of Cooperation Framework

The following issues were added in the second year of technical assistance at the request of ChPT.

- Efficient Inspection at Terminal Gate
- Study on Basic Direction of Master Plan
- Improvement of Synergy of Authority

In this way, the Team has continuously conducted technical assistance in cooperation with ChPT and agencies concerned.

3.12 Arrangement of Study Tour in Japan

Japan has a lot of experience in improving port operation including the successful adoption of measures for decreasing traffic congestion. Therefore it would be useful for officials of ChPT to visit Japan and carry out site visits in order to learn about port operations in Japan.

The chairman i/c and traffic manager of ChPT have been invited to visit Japan in September. They are tentatively scheduled to stay in Japan from 12th to 15th September.

3.13 Presentation Materials on Activities and Outcomes of the Project

Japanese companies including those in the automotive industry are increasing their business and manufacturing activities in Tamil Nadu. It is important to conduct public relations activities on the measures taken to improve port management & operation at Chennai Port under JICA's technical assistance .

The Team created presentation materials which explain the activities and outcomes of the Project over the past 2 years and provide key information to stakeholders in India as well as Japanese companies in Chennai. Furthermore, the Team also visited Bengaluru and made a presentation on the project to Japanese firms there.

4 Outcome and Evaluation of the Project

4.1 Systematic Implementation of Measures for Technical Assistance.

(1) Measures introduced under Technical Issues

The Team implemented measures for the alleviation of traffic congestion in cooperation with ChPT and concerned authorities. Decongestion measures which were systematically organized under the technical assistance are outlined below.

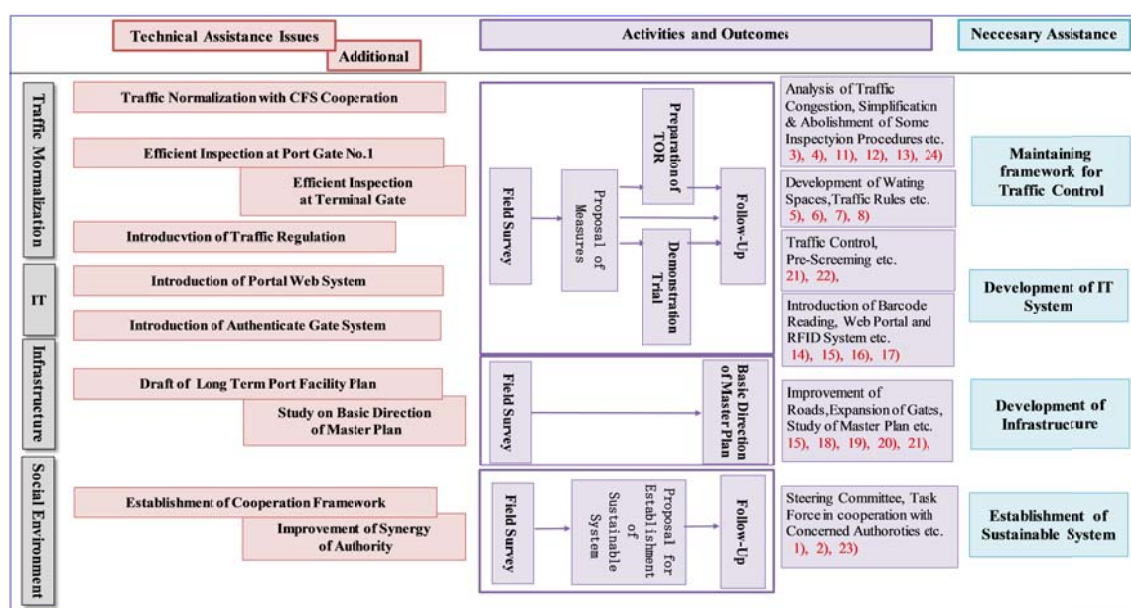


Figure 4-1 Activities Undertaken under Technical Assistance

Major activities and outcomes of the project are listed below. (The numbers in the figure correspond to the items below.)

1) Steering Committee on Improvement of Chennai Port Operation

The Steering Committee(S/C) has been set up to improve the operation of Chennai Port by ChPT, Terminal operators, CFSs, Trucker Associations and JICA etc. Concerned persons can share related information in the committee and tackle traffic problems and so on together.

2) Working Group on Improvement of Chennai Port Operation

The working group(W/G) meeting has also been held as preparatory talks before the S/C as well as to provide an opportunity to discuss various issues on Chennai port management & operation. W/G was chaired by the Traffic Manager and representatives of traffic, civil and mechanical, IT, financial and others offices of ChPT participated.

3) Introduction of a Sticker for a Container Trailer

As trailer drivers who do not carry the proper documents are one of the causes of traffic congestion, a trial was conducted with the cooperation of the private sector in which stickers were attached to trailers when drivers possessed the proper documents. This was a good initiative which demonstrated the willingness on the part of the private sector to cooperate in congestion alleviation measures. However, the sticker system was soon discontinued due to management problems.

4) Simulation Model Analysis for Traffic Congestion

The Team developed a traffic simulation model and showed the qualitative effect of measures for decongestion in the S/C. It is hoped that ChPT and stakeholders will continue efforts to alleviate the congestion.

5) Effective Utilization of TVT Parking (Demonstration Trial)

HEP (Harbor entry permit) was issued to trailer drivers at the TVT Parking located along State Highway 114, about 5km north from Port Gate No.1. Utilizing this parking space, required documents for drivers were pre-checked as a demonstration trial. The area was also used as a waiting space for trailers to discourage drivers from parking trailers along the road while waiting to enter the port.

6) No Parking along internal Roads and Establishment of Waiting Area(Demonstration Trial)

Parking along internal roads encumbers trailers as they move. Parking has been banned at some road sections and a waiting area has been set up for trailers to wait inside Chennai Port.

7) Allocation of Traffic Officers (Demonstration Trial)

Congestion at the intersection in Chennai Port was so serious that traffic control was becoming increasingly necessary. Therefore, traffic officers were allocated at key intersections to give instructions to drivers inside the port.

8) Additional Gate for empty container trailers at DPW terminal

An additional terminal gate for empty container trailers was set up at the area of the DPW terminal which used to be for the handling of iron ore. It has streamlined the traffic flow inside Chennai Port and contributed to alleviating traffic congestion.

9) Pre-Document Check prior to Port entry (Task Force Activity)

Task Force Team was formed at the initiative of Chennai Port Trust to combat traffic congestion. It consists of ChPT, Terminal Operators and CFS association etc. Before entry to the port, trailer drivers are subject to a document check by the Task Force. They are not allowed to enter the port until they show the proper documents.

10) Promoting Traffic Discipline among Drivers (Task Force Activity)

As one of activities of the Task Force Team, trailer drivers are instructed to keep proper intervals by traffic officer while forming a line on the road toward Port Gate No.1. The officer patrols the road on a motorbike. Traffic discipline of drivers is expected to be improved and traffic congestion decreased.

11) Survey of Terminal Gate Operation

With the cooperation of the DPW terminal, the movement of container trailers passing through the terminal gate was recorded by a camera set up at the entrance in order to grasp the efficiency of gate processing. This survey was useful for analyzing the causes of congestion related to the terminal gate and suggesting measures for alleviation.

12) Incoming Traffic throughput Analysis

The Team analyzed the processing capacity of Port Gate No.1, terminal gates and terminal yards in order to identify bottlenecks and proposed measures for upgrading the processing capacity to attain the target at each gate and yard.

13) Continuous Traffic Congestion Survey

The Team conducted a traffic congestion survey outside/inside Chennai Port during every dispatch. The survey results were utilized to grasp the present situation and examine the outcome of efforts to alleviate traffic congestion and so on. Findings were fed back to the study activity on improvement of Chennai Port Operation.

14) Technical Seminar for staff of Chennai Port Trust and CISF

Technical Seminars were held for staff of ChPT and CISF by the Team when the bar-code reading system was introduced as a demonstration trial. Trainees could learn how to use the bar-code reading system in the seminar.

15) Introduction of Bar-code Reading System (Demonstration Trial)

As part of modernization of access control procedures for trailers using IT, the Bar-code reading system was introduced at the Port Gate No.1

16) Introduction of Web Portal System (demonstration Trial)

As one of the demonstration trials to alleviate traffic congestion using IT, Web Portal System has been established to provide congestion information. Everyone can access the information on the number of trailers passing through the Port Gate No.1 on an hourly basis using the website of ChPT.

17) Introduction of RFID System

ChPT has a plan to introduce an RFID (Radio Frequency Identification) System to attach IC tags to trailers with the cooperation of related organizations. The system aims to increase the efficiency of cargo

handling management and gate processing by sharing information among ChPT, CFS and terminal operators etc.

18) Widening and improvement of roads in Chennai Port

The widening and improvement of internal roads have been carried out inside Chennai Port to alleviate traffic congestion. In addition, the traffic flow has been clearly separated.

19) Expansion of Port Gate No.1

Port Gate No.1 is the only gate for container trailers to enter and exit Chennai Port, but the lane capacity was insufficient to cope with the number of waiting trailers. Accordingly, ChPT expanded Port Gate No.1 from 4 to 8 lanes.

20) Widening and Improvement of State Highway 114

State highway 114 is the only road connecting to the Port Gate. Widening and improvement works of Highway 114 are ongoing in order to provide a dedicated lane for container trailers.

21) Development of Approach Road to Port Gate No.1

Insufficient road infrastructure is also one of the causes of traffic congestion. The approach road to Port Gate No.1 has been widened and improved to improve the traffic flow of trailers.

22) Study on Direction of the Master Plan

The workshop on the master plan was held in ChPT. The Team discussed the direction of the master plan and stressed the importance of infrastructure projects as well as the need to further alleviate traffic congestion.

23) Strengthening of Partnership with Tamil Nadu Government

ChPT invited officials of the Tamil Nadu Government to attend the S/C. Officers from Traffic Police and Road section of Tamil Nadu joined the expanded S/C to assist with congestion alleviation efforts.

24) Activity Report of JICA Study

The Team prepared an activity report which details the current state of traffic congestion, analyzes congestion trends, describes the efforts and outcome of measures to decrease congestion and all other study activities undertaken at each dispatch. It is submitted to ChPT, JICA etc. ChPT will utilize the results of the report to take further measures for decongestion.

4.2 Evaluation of Technical Assistance

(1) Optimization of Trailer Flow

The measures implemented for optimizing trailers flow are evaluated as follows.

1) Introduction of a Sticker for a Container Trailer

The sticker introduced during the 1st and 2nd dispatch is no longer being used. It was originally introduced to confirm whether a trailer had cleared the documentation check as it entered the gates. However, as the percentage of drivers carrying the proper documents increased, the need for this system disappeared. According to the survey conducted by the Team, the document possession ratio was improved by 3-4 % at the 6th dispatch, when stickers were no longer used, compared to the 2nd dispatch, when it was first implemented.

2) Simulation Model Analysis for Traffic Decongestion

The simulation model analysis was conducted in order to project the effects of demonstration trial 1 (Barcode reading system), trial 3 (No parking rule and waiting area), and trial 4 (arrangement of traffic officers). The simulation contributed to the optimization of trailer flow as it allowed the relevant parties to visualize the effects of the trials before their implementation.

3) Effective Utilization of TVT-Parking (Demonstration Trial 2)

The utilization of TVT-Parking was originally based on the idea that a trailer driver himself would pick up the HEP. The trial, however, revealed that most of the people who came inside were not drivers but employees of CHA (Customs House Agent), CFS, etc. Therefore, this measure did not directly contribute to the optimization of trailer flow. However, TVT-Parking plays an important function in issuing the HEP; a HEP can be issued at TVT-Parking 24 hours a day while it can only be issued during the day at the central HEP issuance office. In this sense, it contributed to the optimization of trailer flow indirectly.

4) No Parking along Internal Roads and Set-up of Waiting Area (Demonstration Trial 3)

The traffic regulation to prohibit parking along internal roads was not implemented after the demonstration trial and the parked cars are still one of the main factors impeding the trailer flow. On the other hand, the establishment of the waiting area did contribute to optimizing the trailers flow (to some extent). After the trial, four waiting areas were newly established inside the Port which have been used by some trailers. However, despite the establishment of these waiting areas, the number of cars parked along internal roads did not decrease. Accordingly, further enhancement of measures to guide parked trailers to the waiting areas is required as well as compliance with the no parking rule along the internal roads.

5) Allocation of Traffic Officers (Demonstration Trial 4)

Traffic officers continued to be allocated after the demonstration trial. Although just a single traffic officer, security guard or a ChPT officer, was allocated at first, officers from multiple organization as a task force team are allocated lately. The Team also observed that CISF officers were additionally allocated during period of heavy congestion. However, traffic officers require training on traffic control because instructions by traffic officers were sometimes ignored by trailer drivers.

6) Additional Gate for Empty Trailers at DPW Terminal

The implementation of the new DPW gate specialized for empty trailers in April 2015 was one of the effective measures for the optimization of trailer flow. Separating the flow of empty trailers from that of export container trailers has been effective because empty trailers often wait for job orders or proper documents inside the Port.

However, the trailer flow has not been completely separated because empty trailers were still accepted at the DPW IN Gate which was meant for export container trailers. Furthermore, the empty trailer flow and the export trailers flow sometimes crossed at the intersection near the X-Ray inspection area after the implementation of the new gate. Further optimization of the trailers flow can be achieved if these issues are addressed and the empty and export container flows are completely separated.

7) Pre-Document Check Prior to Port Entry (Task Force Activity 1)

The pre-document check, which was conducted on the access road toward Port Gate No.1 during the 7th dispatch, was one of the activities undertaken by the Task Force Team (which consists of ChPT, container terminals, trucking companies, etc).

These screening activities have somewhat contributed to optimization of trailers flow inside and outside the Port.

8) Promoting Traffic Discipline among Drivers (Task Force Activity 2)

The Team observed that traffic officers instructed trailer drivers to drive along a lane, keep proper intervals, etc. during 7th dispatch. The traffic officers were dispatched from trucking companies organized by ChPT. It was the first attempt for ChPT to organize such a team by themselves. Thanks to the instructions from officers, situation in which container trailers prevented general vehicles from proceeding were avoided. Furthermore, together with the restrictions on trailers entering the city area which have been enforced by the traffic police, the traffic flow along the State Highway 114 has greatly improved. These activities definitely contribute to optimizing the traffic flow outside the Port.

Although activities undertaken by the task force team were discontinued at the 8th dispatch, the traffic flow has remained in good condition.

9) Survey on Terminal Gate Operation

Based on the findings from the survey on terminal gate operation during the 6th and 7th dispatch, the Team proposed the TOR for the operational rules on the entry process of trailers at terminal IN Gates during the 8th dispatch. If the TOR is fully implemented, the trailer flow in front of DPW IN Gate will become smoother, which will enhance not only the trailer flow towards terminals inside the Port but also the whole trailer flow towards the Port.

10) Incoming Traffic Throughput Analysis

The Team studied the relation between the trailer processing capacity among major points in the trailer flow and the traffic congestion during the 8th dispatch.

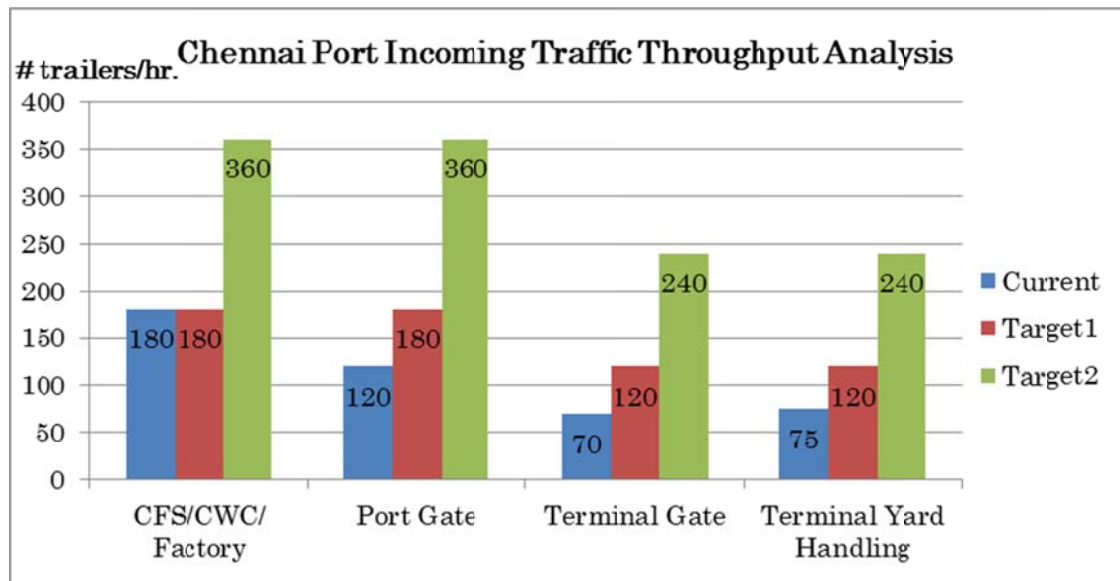


Figure 4-2 The Comparison of Processing Capacity among major Points in the Trailer Flow

The study clarified the target processing capacity of trailers both at the port gate, terminal gates, and terminal yard handling. The target values and the optimization of trailer flow inside and outside the Port can be achieved by both ChPT and container terminals if the necessary improvements are made.

11) Continuous Traffic Congestion Survey

The Team has conducted the traffic congestion survey continuously from the 1st dispatch to the 8th dispatch and summarized the results in the activity reports. Furthermore, the Team tried to optimize the trailer flow inside and outside the Port by making a various proposals based on the results of the survey. The Team believes it is necessary to continue conducting such traffic congestion surveys and propose congestion alleviation measures base on the findings.

(2) Introduction of IT Related Measures

i) Barcode Reading System (Demonstration Trial 1)

The introduction of the system helped alleviate the traffic congestion as the processing time for confirming and recording the entry and exit of trailers at Port Gate No.1 was shortened. The processing time was reduced due to the continuous improvements of the procedures at Port Gate No.1 by CISF.

The Team proposed the establishment of a sustainable system at Port Gate No.1 base on the experience in the trial and the succeeding 6 months of operation of the Barcode Reading System. This proposal can also be applied to the RFID system which will be implemented and operated by ChPT.

ii) Web Portal System

The Team conducted the demonstration trials on Web Portal System during the 7th and 8th dispatch. The aim of the demonstration trial was to show the importance of sharing information on traffic congestion with stakeholders. Although the trial period was short, the Team thoroughly explained its objectives prior to the start of the trial and thus believes the aim was achieved.

However, the system operation was finally suspended after several issues arose. No actions were taken

to resolve these issues despite the fact that the Team covered such matters as the detection of issues, reception of failure report, arrangement of the persons in charge, etc. during its stay in Chennai. The Team thus recognized the necessity of establishing a sustainable system in order to operate the system continuously as described above.

iii) RFID System

RFID system is to improve the processing efficiency at terminal gates. Furthermore, the system will also contribute to improving the efficiency of the reception procedure at Port Gate No.1 and enable the dissemination of more advanced information on traffic congestion by using the information collected by RFID tags.

(3) Improvement of infrastructure

1) Improvement of infrastructure inside the port

The Team has surveyed the status of infrastructure inside the port and has proposed measures to reduce traffic congestion at every dispatch. Based on these proposals, various projects (originally planned by ChPT) such as extension of the gate, widening of the roads, and streamlining of the vehicle flow are being expedited. Accordingly, ChPT's efforts to improve infrastructure inside the port in order to reduce traffic congestion should be positively evaluated.

2) Improvement of access roads outside the port

Widening of State Highway 114 (SH114) has been expedited on the recommendation of the steering committee. Furthermore, improvement works of the approach road from SH114 to Port Gate No.1 are on-going. These projects have been contributing to reduction of traffic congestion.

3) Examination of the basic direction for a master plan

The Team examined the basic direction for formulation of a master plan and proposed some project ideas through holding workshops.

As traffic congestion has been reduced thanks to the congestion alleviation measures that the Team and ChPT jointly conducted, ChPT requested the Team to conduct the master planning study which focuses on infrastructure projects for improvement of port operation.

4) Examination for remodeling of Jawahar dock

The Chairman in charge requested the Team to support the study on the remodeling of Jawahar dock. The dock is located in the center of the port and handles bulk cargoes; however, its facilities are superannuated. The purpose of remodeling the dock is to increase cargo handling efficiency.

(4) Development of Social Environment

1) Steering Committee on Improvement of Chennai Port Operation

The Steering Committee (S/C) has been set up to discuss and implement measures for easing congestion. Concerned authorities can share related information in the committee and tackle traffic problems together. The working group (W/G) meeting, where preliminary discussions are held prior to the S/C, has also been

set up. The Team reported on the status of congestion and presented its survey results which enabled participants to deepen their understanding of congestion issues. After reaching a consensus through discussions, various measures to alleviate congestion have been successfully implemented.

2) Establishment of a sustainable Port Entry/Exit Control System

The Team prepared the TOR on implementing a sustainable Port Entry/Exit Control System based on the results of the demonstration trial on the barcode reading system and the succeeding 6 months of operation. The TOR includes running rules for sustainable operation, an emergency contact plan, a system expansion plan for re-starting the bar code reading system, etc.

Although the TOR has not been implemented, the need to establish a sustainable system is gradually being recognized in ChPT and CISF. In particular, ChPT traffic department held a Working Group meeting on its own initiative with CISF and ChPT EDP section in order to discuss issues related to the demonstration trial on the Web Portal System. CISF also stressed the necessity of establishing a sustainable system for system maintenance at several meetings. In this way, a change in thinking on the part of ChPT and CISF officers was observed

3) Strengthening the Partnership with the Tamil Nadu Government

The Tamil Nadu Government which develops and manages the access roads to the port is also involved in congestion issues. Therefore, ChPT invited officials of Tamil Nadu Government to attend the S/C based on a suggestion by the Team. Officers from the Traffic and Road section of Tamil Nadu have joined the expanded S/C to assist with congestion alleviation. ChPT has also formed a Task Force Team at its own initiative to combat traffic congestion. It consists of ChPT, Terminal Operators and CFS association etc. In this way, the management & operation of ChPT has been greatly improved.

4.3 Objective Evaluation for the Project

The outcomes of the efforts made to decrease congestion over the last 2 years are objectively evaluated as follows.

(1) Outcome of measures for decreasing the number of trailers outside the port

The Team surveyed the congestion status outside the port from the beginning of the study. The number of queuing trailers along SH 114 and Manali area was counted every day during the Team's stay. Trend of the number of queuing trailers outside the port is as follows. The number of queuing trailers depends on the container handling volume; therefore, the figure is converted to the number of queuing trailers per handling volume of 100 thousand containers per month.

Table 4-1 Number of queuing trailer outside the port

No. of Trailers outside the Port	Data Collection Survey 6-7/12/2013	First Year Technical Assistance				Second Year Technical Assistance			
		1st Dispatch 21/7-13/8/2014	2nd Dispatch 30/9-5/11/2014	3rd Dispatch 19/1-7/2/2015	4th Dispatch 13-24/4/2015	5th Dispatch 7-28/7/2015	6th Dispatch 30/9-20/10/2015	7th Dispatch 27/1-16/2/2016	8th Dispatch 22/5-10/6/2016
Number of Trailers by converting the handled containers per month to 100,000									
Maximum No./Day	906	759	1146	502	517	530	628	678	415
Average No./Day	676	278	362	143	245	193	326	391	211
Max No./Day on SH114	–	297	346	217	230	216	332	147	248
Ave No./Day on SH114	–	160	186	53	133	113	130	88	127

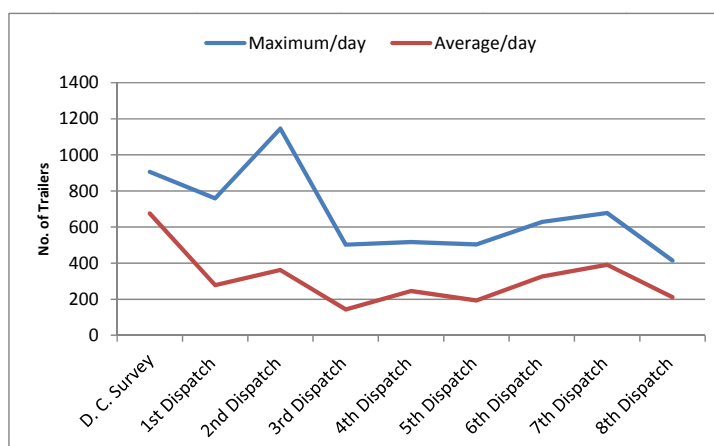


Figure 4-3 Trend of number of queuing trailers outside the port

The maximum number of queuing trailers has clearly been reduced, while the average number of queuing trailers showed a slight declining tendency. Recently, heavy congestion has often been observed at the Manali area but not on SH114. This reason is thought to be due the traffic control efforts by the traffic police and the task force in which trailers have been forced to make queues at the Manali junction far from Port Gate No.1 instead of SH114. Overall traffic control operations will be required.

(2) Outcome of measures for improving the processing time at Port Gate No.1

The processing efficiency at Port Gate No.1 was drastically improved by simplifying the verification process and introducing the bar-code reading system (although the latter has been discontinued).

Table 4-2 Processing time at Port Gate No.1

Processing Time at Port Gate No.1		Jun. 2014	Feb. 2015(during the Demonstration Trial)	Apr. 2015(after the Demonstration Trial)
Average Processing Time / Truck / Lane	IN Gate	3.5	2.5	1.8
	OUT Gate	5.5	2.0	2.3

ChPT intends to introduce a RFID system which is now in the trial stage. After full implementation, it will be possible not only to secure entry/exit control, but also to enhance the processing efficiency at the Gate.

(3) Outcome of measures for reducing the transit time from CFSs to Port gate No.1

The Team also conducted surveys on the transit time (lead time) from CFSs to Port gate No.1 on three occasions. Shortening of the transit time results in significant economic merits for port users. Degree of shortening of the transit time is thought to be an index to grasp the effect of the congestion alleviation measures. The results of the three surveys on the transit time are shown below.

Table 4-3 Transit time required from CFSs to Port gate No.1

Transit Time Required from CFSs to Port Gate No.1	First Year		Second Year		
	2nd Dispatch (2014)		7th Dispatch (2016)		8th Dispatch
	04 Oct.	18/19 Oct.	12 Feb.	13 Feb.	02 Jun.
Average Transit Time during Surveys	28:29 hrs	40:25 hrs	17:43 hrs	19:24 hrs	14:54 hrs
No. of Trailers surveyed	155	200	327	398	129
No. of Queuing Trailers on the Survey days	595	803/689	874	785	497

Note: During the 8th dispatch, the average transit time on June 1st was 7:22 hrs. (no. of samples: 351.) However, no. of queuing trailers on that day was unusually small (only 75 trailers). Therefore, the team regarded this as an anomaly and data obtained is used for reference only

During interviews, Japanese companies in Chennai and Bengaluru confirmed that the transit time in Chennai port has been shortened.

5 Future Issues

5.1 Follow-up for improvement of Chennai Port operation

In the project on improvement of Chennai Port Operation, the Team has conducted various measures for alleviating congestion after examining the status of trailer movements inside /outside the port and the processing situation at terminal gates. The Team also conducted several trials including the use of IT to test the effectiveness of its proposed measures.

Some of the measures introduced have already produced the desired results. However, other measures such as the web portal system using IT require further technical assistance from JICA as ChPT does not yet possess the expertise to effectively operate such as system. In addition, the Indian government intends to introduce a RFID system at all major ports including Chennai Port. It is recommended that the implementation of the RFID and web portal systems be combined in order to increase ChPT's port management and operation capacity. Accordingly, the project on improvement of Chennai Port operation should be extended for an additional year in order for ChPT to gain the expertise which will allow it to sustainably operate these systems by itself.

The technical assistance rendered in this project to date has mainly focused on non-structural (software) measures. Such measure should continue to be refined. However, the modernization of Chennai port is vital to successfully compete with newly developed neighboring ports, and thus it is also necessary to focus on hardware aspects (infrastructure). In discussions on the direction of the Master Plan, ChPT requested assistance for improving the operation of Chennai port by introducing the required infrastructure in addition to following up on the abovementioned software measures.

5.2 Modernization of Chennai Port I

(1) Introduction of a Web Portal System

The Web Portal System, which publishes information such as a Key Performance Indicator (KPI) representing the degree of congestion, is an indispensable measure for alleviating the traffic congestion inside and outside the Port. Although, there are many active Web System around Chennai Port, such as ChPT Homepage, Port Community System, Homepages of DPW/PSA terminals and shipping lines, etc., there is no such a system which provides the PKI for traffic congestion to all the stakeholders including the state government and trailer unions. The Team has proposed the necessity of such Web Portal System to all the stakeholders from the beginning the project and even implemented a demonstration trial during the 7th and 8th dispatch. It is an opportune time to introduce the Web Portal System because the RFID system, which is capable of automatically collecting information as a common indicator of the traffic congestion in real time, is now being implemented.

In addition, traffic control by the Task Force Team or the traffic police has recently been conducted on the access roads outside the Port. Although this is effective for alleviating the traffic congestion, it may sometimes control the trailer flow too much in the suburbs so that only few trailers arrive at Port Gate No.1. Traffic congestion in the suburbs is also exacerbated. The introduction of an IT system to improve the

current situation should be examined.

(2) Improvement of Gate Efficiency and Port Entry/Exit Control System

The demonstration trial on the barcode reading system was implemented at Port Gate No.1 during the 2nd dispatch. Since then, the gate processing efficiency has been continuously improved in Chennai Port. The Team has proposed the implementation of sustainable Port Entry/Exit Control System based on the experience in operating the barcode reading system. Although the proposal has not been implemented yet, the need to establish a sustainable system is gradually being recognized among the stakeholders in Chennai Port.

ChPT is currently implementing the first step of the RFID system for controlling the entry and exit of trailers at Port Gate No.1 instead of the barcode reading system. It is necessary for ChPT to complete the Port Entry/Exit Control system using the RFID system up to the 2nd step, which includes the implementation of the RFID based HEP, in order to modernize Chennai Port. Furthermore, the establishment of the sustainable system proposed by the Team is also required for operating these systems. This remains a challenging issue.

5.3 Modernization of Chennai Port II

The government of India and ChPT should request JICA assistance in formulating the master plan of Chennai Port. The necessary infrastructures need to be developed in order to modernize the port. The main issues related to infrastructure development of Chennai Port are as follows.

(1) Improvement of access to the hinterland

Congestion created by container trailers was the main reason behind this project. Further improvement of access roads to the port is an urgent issue which needs to be addressed. Railroad is extended inside the port, but it is currently not utilized to a great extent. Accordingly, the modernization of railroad infrastructure should be examined to increase the efficiency of operations.

(2) Infrastructure development to ease congestion and enhance cargo handling efficiency

No parking along internal roads, the establishment of a waiting area for trailers, traffic control by traffic officers and widening and improvement of internal roads in Chennai port are positive measures which have been introduced as part of this project. However, further improvement of road infrastructure including the construction of a new flyover needs to be examined. Enhancing cargo handling operations and protecting the environment are also important issues which should be simultaneously addressed.

(3) Competing with neighboring ports

Chennai port is playing an important role in stimulating economic growth around Chennai area as the largest port in eastern India. However, new ports such as Kamarajar and Kattupali have recently been

developed which feature modernized port facilities. Therefore, the modernization of infrastructure at Chennai port as well as management & operation need to be examined. To compete with neighbouring ports, it will be necessary to determine which types of cargo Chennai port should target. In this regard, a cooperative relationship with neighbouring ports should be fostered.

(4) Improvement of Customs service

Customs service procedures inside/outside the port for export/import container also have a significant impact on traffic congestion. Japanese companies which utilize Chennai port have pointed out that their business activities are hampered by the inefficient customs procedures. Therefore it is important to grasp the situation and identify aspects that can be improved through interviews with stakeholders and so on.

(5) Timely development of infrastructure through PPP and ODA

Proper procurement of a budget is necessary to develop port facilities in a timely manner. As the government is facing financial constraints, PPP (Public Private Partnership) is one possible effective scheme for the development of port facilities. However, a PPP scheme is only applicable to profitable facilities. The Government will have to finance the development of non-profitable facilities.

(6) Implementation of sustainable development including environmental protection measures

Environmental burden related to port activities should be reduced at Chennai port due to its proximity to the city. Iron ore and coal are no longer handled at Chennai port due to environmental concerns but the port does handle gravel and fertilizer which may generate dust. The working environment also needs to be improved such as providing a sufficient number of toilets and shaded break areas for trailer drivers, as well as ensuring that there is a sufficient water supply.

Recently, ChPT launched a trial of the use solar energy for small buildings. Further efforts to promote a clean environment should be elaborated in a comprehensive master plan.