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Research Article

Planning and Designing of Truck Parking Terminal at Kandla Port, Gujarat

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ABSTRACT

This study focuses on the prediction of truck traffic demand along with the variations in retention times. Furthermore, objective of this study is extended to plan and design a truck parking terminal based on the predicted demand for the smooth movement of trucks around the road network in the port vicinities. Various issues resolved for planning of truck terminal namely daily commercial traffic, retention time of commercial vehicles, bay size of vehicles depending upon the length of vehicle including clearance facilities required for drivers at truck parking terminal including amenities and location suitability for terminal. Proceeding towards the demand estimation, first stage is carried out which include primary and secondary data collection. Primary data collection is carried out by three types of surveys namely, Classified Vehicle Count (CVC), Origin-Destination Survey (O-D) and Drivers Perception Survey. Secondary data used is collected from KPT authorities, which comprises details of cargo commodities handled by port for past ten years through various modes of transportation and data of liquid cargo. O-D Survey is analyzed to get retention time (R.T.) of the different category commercial vehicles. CVC data is used to calculate Monthly Average Daily Traffic (MADT) and Seasonal Factor (S.F.). AADT is calculated by using Average Daily Traffic (ADT) of previous year (2015-16) and S.F. of present year (2016-17). Average growth rate is found to be 7 % from the data of cargo of past ten years. Analysis of driver's interview survey involves information on location of parking, facilities at parking terminal involving amenities as well as ITS technology. Planning of truck terminal is carried out considering the design life of 10 years. Total design period is divided into 3 Phases. Base year is 2016-17, Phase-1 of 2017-18 to 2020-21, Phase-2 of 2021-22 to 2023-24 and Phase-3 2024-25 to 2027-28. Based upon R.T. time 3 types of parking are generated namely short term, medium term and long-term parking. Bays for parking are derived considering parking turnover and terminal is planned for various scenarios i.e. pessimistic (5%), optimistic (9%) and normal (7%). This study is of great importance which highlights the methodology for estimating parking demand and designing truck parking terminal especially for port area where large no. of cargo is handled. Provision of centralized truck parking terminal will lead to reduce congestion, pollution and efficiency and effectiveness of transportation system will improve. The results of this study are expected to be helpful for port operating authorities for planning road network as well as terminal facilities in KPT premises. Also, the effectiveness of implementation of intelligent parking system can be experimented using microscopic simulation technique. Further, the study results may be helpful for evaluating the financial and economic viability of operations and maintenance of parking terminal.

Keywords: Classified Vehicle Count, Parking, Origin-Destination Survey, Planning, Retention time.

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Research Article

1. INTRODUCTION AND BACKGROUND

Kandla port in Gujarat handles more than 210 lakh MT commodity annually through road network. It is evident that Kandla port has extensive trucking activity. Further, truck traffic is expected to grow substantially in the coming future with the increase in economic activities. It becomes important to plan and accommodate the efficient movement and parking facilities of all goods carrying vehicles under the influence of the port. This will result in time and cost savings for all the associated transport agencies. The present parking shortfall is evidenced by the many trucks parked along shoulders near rest areas, for refreshments and also at other roadside locations. This issue has the enormous adverse effect on safety and also causes travel time delays of through traffic. This study provides an overview of the total truck traffic movement in different directions along the different links of the road network around Kandla port. The present study focusses on parking issues at Kandla along with the identification of possibly feasible locations near port area. Further, the subjective assessment of various alternatives for providing the parking has been carried out. These alternatives can be very useful for the decision making from both the perspectives of transport agencies and port authorities. For arriving at the design capacity of truck terminal parking, expected traffic in future for a designated design life is to be considered. In addition, the parking retention period of different types of goods carrier vehicles is evaluated from the origin destination and driver questionnaire surveys. In the present study, traffic is forecasted for various scenarios of design life of such as 3 years, 6 years and 10 years. In addition, corresponding increase in truck parking capacity is forecast using the seasonal factors calculated from the commodity data of 10 months. Moreover, different type of goods carrying traffic is also considered for traffic forecast as well as for the provision of parking bays. Keeping in view normal, optimistic and pessimistic scenario in the growth of port traffic, vehicular growth rate for normal, optimistic and pessimistic is considered to generate three scenarios of parking demand at the terminal.

Ahemad et.al. [1] developed an “On-street parking model for downtowns in urban centers”, that incorporates the often-neglected delivery demand of delivery trucks. They considered behavior of the driver of truck driver. In this paper, relationship between passenger vehicles’ parking and truck delivery behaviors are generalized and provide tools for policy makers to optimize the trade-offs in parking space allocation, pricing, and aggregate network congestion. Dierke et al. [2] used Intelligent transport system to counter the lack of parking capacities and unsafe parking. They developed Intelligent solution for more efficient use of existing parking capabilities are developed, tested and implemented in addition to the continuous construction and expansion. Using intelligent transport systems, the existing parking spaces for trucks will be optimally utilized.Nourinejad et al. [3] in their thesis of “Truck parking in urban areas: Application of choice modelling within traffic microsimulation” develops different types of parking policies are considered like time restrictions, congestion pricing, space management, enforcement. An econometric parking choice model is developed that accounts for parking type and location and traffic simulation module is developed that incorporates the parking choice model to select suitable parking facilities/locations. The models are demonstrated to evaluate the impact of dedicating on-street parking in a busy street system in the Toronto CBD. The results of the study show lower mean searching time for freight vehicles when some streets are reserved for freight parking, accompanied by higher search and walking times for passenger vehicles.

Roca-Riu et al. [4] in their thesis of “Parking slot assignment for urban distribution: Models and formulations” develops advance booking system. Such a tool should be fed with criteria for allocating requests to time slots. In this paper we discuss alternative criteria for the parking slot assignment problem for urban distribution and we propose the use of mathematical programming formulations to model them. Several models are proposed, analyzed and compared among them. Bismark [5] considered impact of economy on the transportation infrastructure is considered. Three econometric frameworks (ordinary least squares, random-effects and random-parameters models) were used to investigate the impacts of transportation infrastructure expenditure across countries using data from 1992 to 2010. In this it is found that the estimation results showed considerable variability across countries, with the impact of transportation infrastructure expenditure varying greatly as a function of the country’s existing transportation infrastructure and the reliance of specific economic sectors on transportation in each nation.

Extensive demand for truck parking at Kandla is significantly increasing due to several factors. These factors include the growth in truck (roadway) traffic, which indirectly reflects increase in population and economic activities

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Research Article

particularly the increasing volume of imports that serve this massive consumer base. Sufficient supply of truck parking is necessary for catering the effective movement of steadily growing traffic. The main purpose of proposed Kandla port truck parking terminal is to provide the basic facility for parking trucks, which are otherwise, parked along roadside and thus leading to traffic congestion and other possible traffic related problems. Nevertheless, a terminal provides a resting place for truck drivers while offering facilities like loading or unloading docks, fuel stations, banks, refreshment areas etc. Traffic forecasting model and cargo handling demand model presented in this study may be useful for KPT in planning future operations. The study provides an analysis of the issues and recommendations that provides the framework for a public/private partnership to ensure safe truck parking practices at Kandla. In addition, analysis of the issues surrounding truck parking, and multi-faceted strategies to achieve adequate and safe truck parking in KPT is also covered in the study To provide solutions for short and long-term truck parking issues at Kandla port, this study conducted to investigate the need for providing truck-parking facilities. The study also recommends potential truck parking facility locations in the premises of KPT. The focus of the study is on regional truck parking needs including various basic amenities and the patterns of truck parking in the KPT area.The study also aims at congestion mitigation in Gandhidham city, efficient movement of goods and reduction in pollution. Further, results of this study can be useful for the identification of critical traffic congestion points within the premises and may be helpful for developing various strategies for improvement in the efficiencies of truck movement.

2. METHODOLOGY AND DATA COLLECTION

2.1 Methodology

Overall methodology adopted in the present study consists of reconnaissance survey, data collection, demand analysis, design and layout of parking terminal and basic amenities attached to the parking terminal and conclusions. Reconnaissance survey helps in understanding of the existing field conditions and the possible locations of data collection points. Data collection includes the collection primary data and secondary data of traffic volume of different type of vehicles and commodities in different directions, retention period through origin-destination and driver response surveys respectively. Data analysis includes traffic volume and composition, forecast using seasonal factors. In addition, the analysis part includes the estimation of parking demand for planning parking facilities along with the assessment of various alternatives of parking terminal location. Further, the last stage deals with the financial evaluation of different feasible alternatives of parking pricing from both the perspectives of operator and user and provides recommendations for successful implementation of this project.

2.2 Data Collection

The survey was carried out for assessing the present scenario of truck parking patterns. In the survey, it has been observed that trucks are haphazardly parked along the shoulders and ramps of different roads in the vicinity of Kandla port area. This study is also useful for the identification of possible causes of traffic chaos and utilization of different roads. In addition, various potential survey locations for traffic volume counts that can be considered for analysis are identified as shown in Figure 1.

Planning of truck terminal parking requires data containing number of truck arrivals and departures per day from different entry or exit points of port, along with the consideration of vehicular type and their halt time at port/port area. Different roads carrying goods traffic as well as entry/exit points for different commodity carrying vehicular types in Kandla port are presented in figure 1.

Two different types of vehicles like dry commodity and liquid cargo carrying vehicles are considered in this study.Six locations of data collection at which volume count surveys were carried out include three West Gates (gate-1, 2 & 3), Zero-point circle, Liquid cargo circle, Kandla bypass circle. Three west gates serve as entry/exit points for traffic carrying dry commodities and whereas, liquid gate junction serves as entry/exit point for liquid cargo carrying traffic. Kandla bypass junction serves as entry point in to Kandla bypass road for traffic coming from State Highway 4. Liquid cargo junction connects liquid cargo terminal gate and zero-point intersection. From preliminary surveys, it is observed that most of the liquid cargo traffic is utilizing Kandla bypass for entering liquid cargo junction. Zero point

Journal of Information Systems Engineering and Management
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Research Article

circles are the most critical intersection at which 12 different traffic directions are observed. Vehicles from Gandhidham and through Kandla bypass for WG-1, WG-2, and WG-3 negotiate from this junction. This intersection serves as common point of passage for all the traffic entering/exiting the three west gates located (West Gate-1, 2 & 3).

Significance of selection for above survey locations is at West Gate – 1,2& 3 Entry and exit of different category vehicle can be observed and noted. At West Gate – 2 Movement of vehicle beyond WG-3 can be available and Retention time of different category vehicles at WG-2 is available. At West Gate – 3 Movement of vehicle beyond WG-3 can be available. At Zero-point junction Vehicles from Gandhidham and through Kandla bypass for WG-1, WG-2, and WG-3 negotiate from this junction. It is a main junction of congestion as movement of vehicle occurs in 12 directions at this junction. At Liquid Cargo (L.C.) Junction Traffic from total 5 direction merge at this junction, Traffic movement from Kandla bypass to oil jetty and vice versa at this junction, Traffic of liquid cargo (tanker) by road is only available at this junction. At Kandla bypass junction Traffic diversion towards bypass is observed and noted at this junction, All traffic moving towards Kandla port negotiate through this junction through either kandla bypass or Gandhidham city.

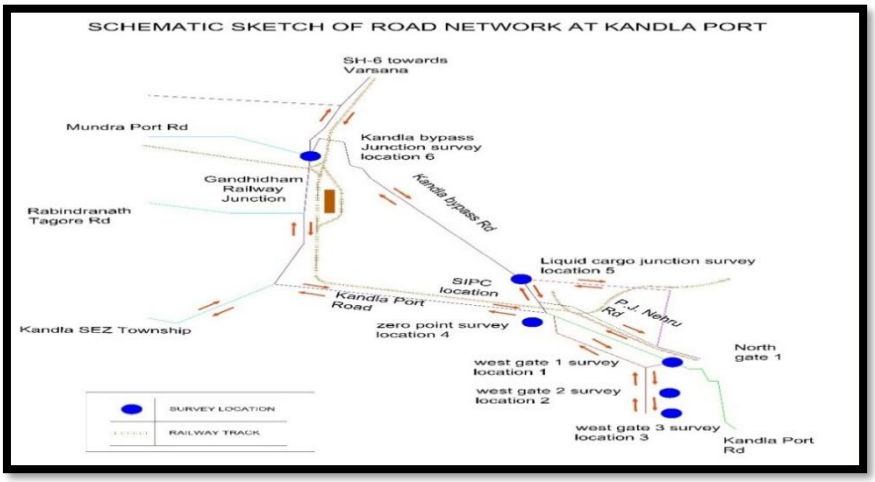

Figure 1 Schematic Sketch of road network at Kandla.

Planning of centralized truck parking terminal requires estimation of capacity for certain design life, which requires traffic data (present as well as historical), retention time of each vehicular category at Kandla port premises. Apart from this, other factors like existing parking facilities and patterns, total goods transported through various modes, existing land use data at port area, number of trucks arriving and departing from port on daily and monthly basis also influence the traffic forecast and thereby capacity of the parking terminal. For collecting the required data, three different types of surveys are carried out namely Classified Vehicle Count (CVC) surveys, Origin- Destination surveys and driver response surveys. Surveys were carried out for total duration of seven days around the clock at the identified locations. CVC Surveys commenced at 01:00 am on 21 July 2016 and lasted until 01:00 am on 28 July 2016. CVC survey template consists of volume count of different types of possible commercial vehicles that are generally used for goods movement, type of commodity carried and direction of travel.

Primary Data consists of Excel sheet containing traffic count data of seven days around the clock (CVC), Drivers' response data collected from roadside drivers' interview, Excel sheet containing O-D survey data for complete survey period.

Secondary Data include Annual cargo handled at the port (commodity and its type) during last ten years, Drawings indicating existing road network and facility-layout of KPT, Current land use plan and master plan of Kandla port / Kandla port area, Past 10 months' data of trucks at identified entry/exit points of dry cargo gates, Bifurcation of cargo data handled by rail, road and pipeline on yearly basis, Data of tankers which negotiates at port area daily.

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Research Article

3. DATA ANALYSIS

Data obtained during survey work is utilized for the analysis to develop efficient parking facility at port area. Analysis is carried out in different stages as explained below.

3.1 Commercial Heavy Vehicle Count Survey

CVC data has been analyzed by considering the historical data of dry cargo traffic at each gate, from last 11months'data for the year 2014-15 from the preliminary survey; it was observed that total traffic in the port area could be classified into two types of Heavy Commercial Vehicles, namely trucks and trailers. This classification is considered per the guidelines of IRC-03, as explained in the section of data collection. From the analysis of CVC data, proportions of trucks and trailers are derived for each of the entry/exit points, namely West Gate-1 (WG-1), West Gate-2 (WG-2), West Gate-3 (WG-3), and Oil Jetty Gate as shown in Table 1.

Table 1 Proportion of Truck and Trailer

	Proportion (%)	
Location	**Truck**	**Trailer**
WG -1	86	14
WG – 2	53	47
WG – 3	1	99
Oil Jetty Gate (Tanker)	10	90

It can be seen from table 3 that major composition of trailers of about 99% and 90% is observed at WG-3 and Oil jetty gate respectively. Major proportion of trucks of about 86% is observed at WG-1. In the case of WG-2, proportion of trucks and trailers are almost same with minor difference of about 6%.

3.2 Retention Time Analysis

Retention time is the time for which different category of vehicles occupy the space of KPT premises except loading-unloading time. This forms a basic input for estimating parking capacity to be provided for the horizon years. Analysis without consideration of retention time either may result in over estimation or under estimation of capacity and it may ultimately result in huge economic loss. Retention time data helps in understanding of haul time of different vehicular types and result in optimized capacity to be adopted for the design of the parking Terminal. Retention time data is made available from the analysis of O-D survey is considered. Based on the extracted data, retention time is categorized in to three different types such as retention time less than or equal to one hour, retention time between 1 to 3 hours, 3 to 5 hours. Based on extracted O-D survey data available (sample size 152) traffic is estimated for the base year, 3rd year horizon (2019-2020), 6th year horizon (2022-23) and 10th year horizon year (2026-27) by considering traffic growth rate as 7%.7% growth rate is calculated from the historical commodity data of past 10 years.

3.3 Container Traffic Demand

Demand for container traffic is derived assuming all cargo containers will be transported by road transportation only, as no details are available regarding bifurcation of cargo container transportation by various modes. Parking bays required for the said cargo container has been derived by considering retention time of truck as these all containers are of 20ft long. (TEU)

3.4 Planning Horizons and Demand Scenario

For the present study, truck parking terminalis to be planned for horizon of 10 years. For the sake of ease of implementation and incorporating uncertainties, the entire planned period is divided into 3 intermediate horizons: Phase-I, Phase-II, Phase-III. Based on AADT and retention time for various categories of vehicle (truck, trailer and tanker) number of parking bays required is calculated in terms of AADPD. Base year for the project is 2016-17 and planning horizon is for 10 years from (2016-17 to 2026-27).

From the historical data of traffic handled by Kandla Port, it is observed that the average traffic growth is 7%. Considering this as the normal scenario of traffic growth, vehicular traffic growth trends are considered as under for

Journal of Information Systems Engineering and Management
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Research Article

prediction of demand for parking at truck terminal:

Normal growth scenario: This scenario is the basic scenario and is based on the growth rate obtained from historical data of import and export at the port. Growth in parking demand at 7% p.a. is considered for building this scenario.

Optimistic growth scenario: This is attributed to increase in GDP growth rate of India and higher industrial growth in the hinterland or there may be shift of modal share of commodities movement from railways to roadways. Growth in parking demand at 9% p.a. is considered for building this scenario.

Pessimistic growth scenario: This scenario presents the estimates of demand and revenue in case of decline in the industrial growth rate / GDP growth rate in the hinterland of the port or due to possible shift of commodities movement from road to railways or waterways in future. Growth in parking demand at 5% p.a. is considered for building this scenario.

Figure 2 below shows vehicular growth trend from base year to horizon year considering above-mentioned growth scenarios.

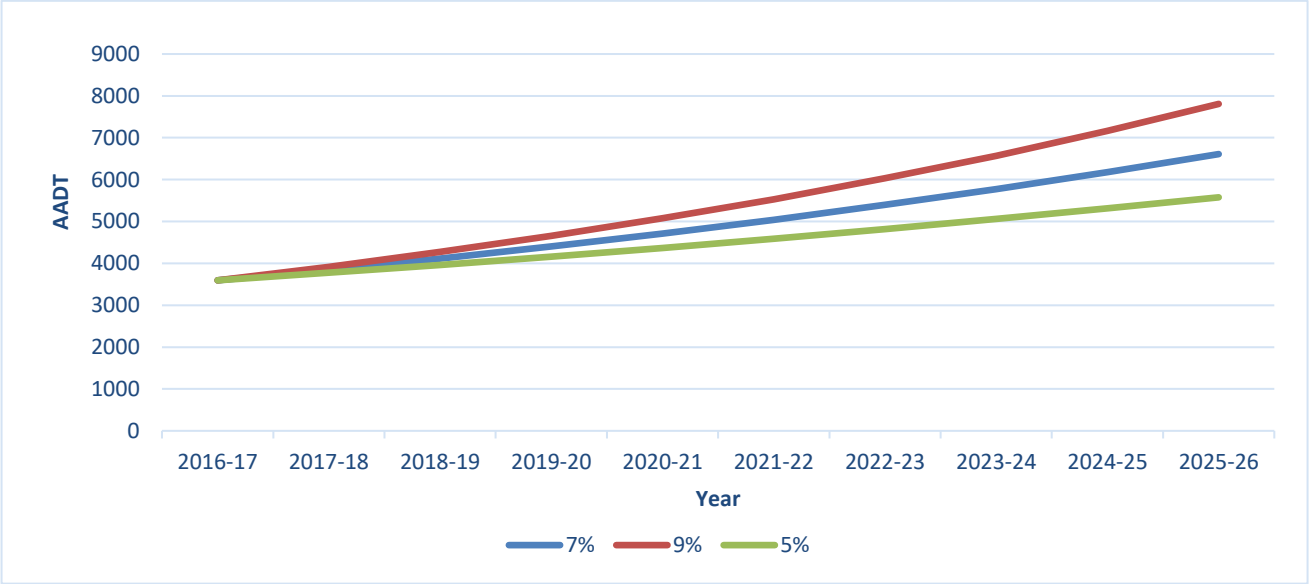

Figure 2 Growth trend of Vehicle

3.4 Total demand, Incremental demand and Bay demand requirement for different growth scenario

The construction of truck parking terminal is divided in three phase as mentioned in Table 2; total phase wise parking demand with different growth rate (7%,5% and 9%), incremental demand and bay demand is mentioned below in different tables. Depending on the duration of the parking, the demand has been classified as under:

Table 2 Type of Parking showing duration and turnover

Type of Parking	Parking Duration	Average Parking Duration	Parking Turnover
Short-term	Up to 1 hour	1	24
Medium term	1-3 hours	3	8
Long-term	3-5 hours	5	5

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Research Article

For Normal Growth Scenario (7%),

Table 3 Vehicular demand as per @ 7% growth rate

7% Growth rate				
	Base year	Phase-I	Phase-II	Phase-III
Truck	885	1084	1328	1741
Trailer	615	753	923	1210
Tanker	2095	2566	3144	4121
Container	165	411	657	822
Total	**3760**	**4814**	**6052**	**7894**

Table 4 Incremental Demand @ 7% growth rate

	Phase-I	Phase-II	Phase -III	Total
Truck	1084	244	413	1741
Trailer	753	170	287	1210
Tanker	2566	578	977	4121
Container	411	246	165	822
Total	**4814**	**1238**	**1842**	**7894**

Table 5 Bay demand @ 7% growth rate Phase – I

Hours	Type of parking	Truck	Trailer	Tanker	Container	Total
1	Short term	11	20	83	4	118
1-3	Medium	102	25	73	39	239
3-5	Long term	0	20	0	0	20
	Total	**113**	**65**	**156**	**43**	**377**

Table 6 Bay demand @ 7 % growth rate for Phase-II

Hours	Type of parking	Truck	Trailer	Tanker	Container	Total
1	Short term	14	24	101	7	146
3	Medium	125	31	89	62	307
5	Long term	0	24	0	0	24
	Total	**138**	**79**	**191**	**69**	**477**

Table 7 Bay Demand @ 7% growth rate Phase-III

Hours	Type of parking	Truck	Trailer	Tanker	Container	Total
1	Short term	18	31	133	9	191
3	Medium	163	40	117	77	397
5	Long term	0	32	0	0	32
	Total	181	104	250	86	621

Similarly, Bay demand is calculated for Optimistic (9%) and Pessimistic (5%) growth scenarios.

4. DESIGN OF PARKING TERMINAL LAYOUT

4.1 Area distribution

Area for truck parking up to horizon year is divided into three phases. Land required for construction of parking terminal with normal growth rate (i.e. 7%) of traffic is around 21 acres. Construction of Truck Parking Terminal in Phase-I will occupy total area of 13.76 acres including amenities and other service facilities whereas 3.6 acres' land is

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Research Article

to be kept reserved for Phase-II and Phase-III construction each. Area is distributed per the bays requirement and requirement of amenities with different scenarios.

Area of Phase-I will include 334 parking bays with dormitories, canteen, admin office, service station, shops, petrol pump, staff parking, transporter's office, toilet and washrooms. Phase-II and Phase-III will accommodate parking bays of 74 numbers and 127 numbers with additional dormitories respectively.

4.2 Bay sizes

Forecasted parking demand helps in estimating the number of bays required for parking of heavy commercial vehicles at centralized parking area Depending on the haul time of different vehicles, three types of parking categories are considered which include short term parking (1 hour), medium term parking (1 to 3 hours) and long term parking (3 to 5 hours).

As most of the commercial vehicles approach to Kandla port are in the size of 20 ft. and 40ft., parking bays are planned for two categories of vehicles, Truck and Trailer. Bays for Tankers are also planned per their proportion as 10% and 90% for 20 ft. and 40 ft. size respectively. Bay size based on commercial vehicle segment is planned as shown in Table 8, considering standard size of trucks and trailer per IRC 3, 1983.

Table 8 Size of CV per IRC 3, 1983 and Size of Bays Provided

Vehicle Type	Size of Vehicle	Size of Bay
Truck/Tanker	11 m X 2.5 m	12 m X 3.5 m
Trailer/Tanker	18 m X 2.5 m	19 m X 3.5 m

4.3 Parking and Circulation Patterns

Different category vehicles require different parking patterns. Various parking patterns, which are in use in general practice, explained in sections below.

Parallel parking

The vehicles are parked along the length of the road. Here there is no backward movement involved while parking or un-parking the vehicle. Hence, it is the safest parking from the accident perspective. However, it consumes the maximum curb length and therefore only a minimum number of vehicles can be parked for a given curbed length. This method of parking produces least obstruction to the on-going track on the road since least road width is used. It is suitable for urban area and almost neglected for the parking at port area.

Perpendicular / Right angled parking

In right angle parking or 900 parking, the vehicles are parked perpendicular to the direction of the curbed line. In this type of parking, the vehicles need complex maneuvering and this may cause severe accidents. However, it can accommodate maximum number of vehicles for a given curbed length.

Angular Parking

300parking -The vehicles are parked at an angle of 30 with respect to the road alignment. In this case, more vehicles can be parked compared to parallel parking. Delay caused to the track

450 parking - As the angle of parking increases, more number of vehicles can be parked. Hence compared to parallel parking and thirty-degree parking, more number of vehicles can be accommodated in this type of parking. Moreover, it is best suited for heavy commercial vehicles as it provides easy access for entry and exit from bays. Hence, from the characteristics of various parking patterns, best-suited parking pattern amongst all above, for truck parking terminal is angular parking at 450 angle and it is considered for planning of centralized truck parking terminal at KPT.

600 parking -The vehicles are parked at 600 to the direction of road. More number of vehicles can be parked in this parking type. This type of parking is best suitable for LCV and small cars. For large vehicles, entry/exit from bays may become difficult.

Roads are provided to access the parking bay location inside the parking terminal. Width of road is provided by considering design-turning radius for trucks, trailers and tankers. Road which is giving access to trailer and tanker

Journal of Information Systems Engineering and Management
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https://www.jisem-journal.com/

Research Article

bays is provided with width of 15 m. Minimum turning radius derived for trailers and big tankers in length is 12.2 m. Roads which is giving access to truck bays is provided with 9 m. width by considering minimum turning radius for trucks.

4.4 Truck Parking Terminal Layout

Centralized truck parking terminal

Truck parking terminal for the commercial vehicles is proposed on Kandla bypass road and /or location allotted for SIPC near zero-point junction (reference Master Plan of Kandla) for 10 years' horizon period i.e. for 2026-27. Lay out of truck parking terminal including all amenities and service facilities for 10 years' horizon is briefly explained in figure.

Phase wise planning for terminal per area calculated above is carried out for 3rd, 6th and 10th year of horizon periods for traffic growth @ 7% and 9%respectively considering additional bays requirement for each of the phase and corresponding figure showing layout of it is as below.

Truck Lay-Byes

Truck lay byes are designed to accommodate the vehicles under emergency or for very short duration. Truck lay byes are planned considering guidelines of Planning Commission of India and NHAI.

Journal of Information Systems Engineering and Management
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Research Article

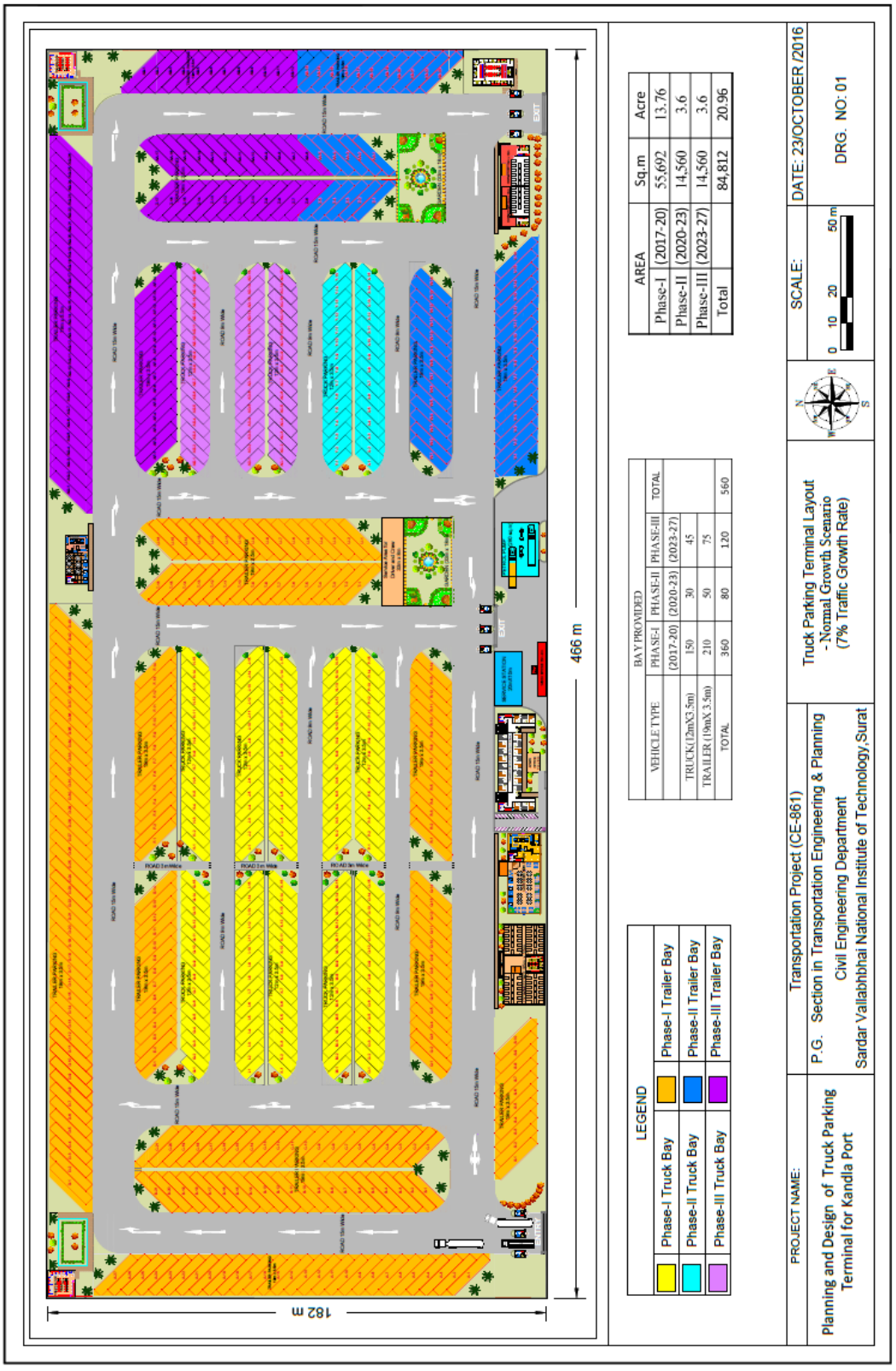

Figure 3 Truck Parking Terminal Layout for Normal Growth

Journal of Information Systems Engineering and Management
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https://www.jisem-journal.com/

Research Article

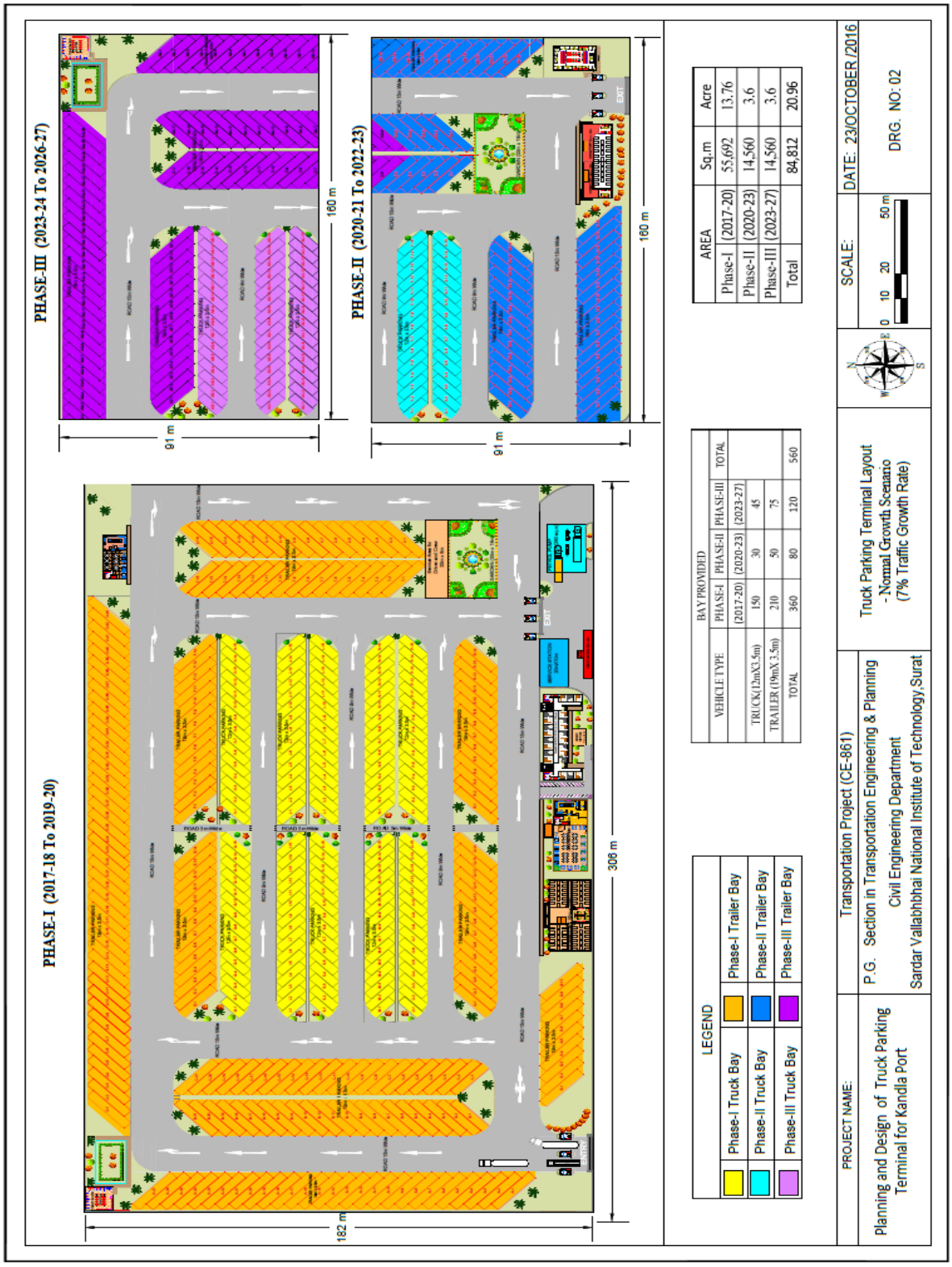

Figure 4 Phase wise Layout for Normal Growth rate

5. ANALYSIS OF LOCATION FOR TRUCK PARKING TERMINAL

During reconnaissance survey, four tentative locations, which are suitable or feasible for the construction parking, were identified. Estimation of parking demand for the horizon year forms a deciding factor for requirement of area

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Research Article

for centralized truck parking terminal. From the estimated parking demand, it is observed that total area of 21.25 acres is required for the parking terminal construction. This estimated area also includes the space for the provision of basic amenities for vehicles as well as drivers.

Identified locations for provision of parking terminal are as follows:

• Area near existing parking beside WG-1

• Space available in front of WG-2

•Space available along Kandla bypass road.

• SIPC 2 Location near Zero Point Junction

• Existing land available near KPT office along Gandhidham-Kandla road.

The subjective comparative assessment of each of the available alternatives is carried out to arrive at the best feasible in terms of financial viability, giving due considerations to the driver's preferences. For this purpose, the advantages (pros) and disadvantages (cons) of each of the identified areas are listed out in sections.

Besides WG –1

Existing space available near WG – 1 as shown in figure 28 and 29can be expanded to meet the future traffic demand. Few pros and cons of this area are discussed.

Pros of this location: -

• This location is easily accessible from WG -1, WG-2, and WG 3 and sufficient vacant land is available at these locations so that effective parking spaces with all the amenities can be provided.

• This location is at the core zone of the port area and located far away from National and State Highway and hence, traffic on these roads will not be affected.

• Efficient use of land resource is possible.

• Unused land may be used for development of parking premises, which will have economic benefits as well.

Cons of this location: -

• As this location is just opposite to the West Gate-I, vehicles entering in and exiting might get affected from the parking traffic.

• Land is not cordoned.

• This location does not meet the horizon year (2026-27) land requirement for providing parking at Kandla port.

Opposite to West Gate-2

Pros of this location: -

• The vacant land just opposite to the West Gate -II is easily accessible from all dry cargo gates.

• Traffic of NH-8 may not get affected.

• Use of unused land may lead to economic benefits.

• All amenities required for parking may beaccommodated considering the space availability.

• Soil is marshy and cohesive.

Cons of this location: -

• Land has predominant effect from backwaters of the sea.

Space available at Kandla Bypass

Satellite image of location as shown in figure is located around 18 km from port gates on Kandla bypass road. Reason for selecting this location is to restrict traffic through Gandhidham city and all category vehicles can easily have accommodated, as large space is available.

Journal of Information Systems Engineering and Management
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Research Article

Pros of this location: -

• Greater possibility to integrate tankers with trucks and trailers for parking.

• City traffic in the vicinities of the port will not get affected.

• Transporters' offices are also located nearby Kandla by pass road, so probability for parking the vehicles may be increased.

Space available near KPT Office along Gandhidham-Kandla road

Pros of this location: -

• There is no investment for developing separate parking area.

Cons of this location: -

• Traffic of city and NH-8 may get affected due to entry and exit of vehicles to those nearby above parking spaces.

• It is nearly around 12 km far away from port gates so proper, integration becomes difficult and drivers may not prefer to use it.

• It is uneconomical to provide integrated facilities as land costs will be high as the space is in nearby city area.

SIPC Location 2(Smart Industrial Port Location)

Pros

• Greater possibility to integrate tankers with trucks and trailers for parking.

• City traffic in the vicinities of the port will not get affected.

• Parking area is near the port.

• Land acquisition will not be a problem.

Cons

• The land is submerged with back-water from ocean hence bearing capacity of soil is less which needs further improvement thus would increase the construction cost.

• It is near railway crossing, which may cause traffic congestion, as there will be direct interaction of incoming truck to parking and truck and trailer passing the crossing.

6. CONCLUSIONS

Detailed study of KPT premises, various visits to KPT premise, detailed analysis of data and various models developed during whole feasibility study project lead us to reach up to following conclusions.

Kandla handles almost more than 200 lakh MT commodities annually through road network, which results in extensive trucking activity. Further, historical trend shows substantial growth in truck traffic every year and is expected to grow substantially in the coming future with the increase in economic activities. As, officially, there is no provision of parking with all mandatory rules and regulation and all necessary service facilities at port area/ within KPT premises, currently, it becomes highly important to plan and accommodate the efficient movement and parking facilities of all goods, carrying vehicles under the influence of the port. This will result in time and cost savings for all the associated transport agencies. The present parking shortfall is evidenced by the many trucks parked along shoulders near rest areas, for refreshments and other locations. This issue has the enormous adverse effect on safety and travel time delays.

Parking demand is derived for centralized truck parking terminal considering traffic growth 7%, 5% and 9%. Demand calculation for other than 7% growth rate is carried out to show different scenarios and possibilities that may occur/happen at KPT in upcoming years. Though, based on historical cargo traffic data, most optimal growth rate considered as 7%, after addition of container traffic data which were made available to SVNIT few days ago, we recommend to implement the project per layout made for 9% traffic growth, as total number of bays planned in this layout are meeting the required demand after addition of container traffic which is supposed to be commence by

current year (as per information provided by KPT).

Location analysis shown in chapter 10, proposed us various locations for set up of truck parking terminal at KPT. As per suggestions of KPT officials and considering land availability which can fulfill our demand, among all those locations, land available for SIPC -2 (see Master Plan of Kandla) and/or location on Kandla bypass are the two best suitable locations which are briefly described in sub topics10.5 and 10.3 respectively.

After visits made to these locations and after detailed study of various practical and technical points of above two locations, we recommend selecting a land available on Kandla by-pass road as, cost of construction may be lower which would be very higher in case of SIPC 2 location because of very high ground water table in that area. Land available on Kandla by-pass road is required to be filled by earth or muroom and there will be easy access to parking for all category vehicles, who will approach towards and from the port. Moreover, in proximity of an area most of the transporters offices are located which may increase the probability of parking demand. Cons described for land for SIPC-2 clearly indicates that high cost to be implied for construction due to poor bearing capacity of soil, as soil is submerged with backwater from ocean. Moreover, this location is near railway crossing, which may lead to congestion, as there will be direct interaction of incoming truck/trailer/tanker to parking and truck and trailer/tanker passing the crossing.

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