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# USER MANUAL- PORT PERFORMANCE MONITORING

## CAP-HAITIEN PORT REGULATORY STRENGTHENING PROJECT

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# ACRONYMS

| | |
|---|---|
| APN | Autorité Portuaire Nationale |
| CHP | Cap Haïtien Port |
| MHC | Mobile Harbor Crane |
| PI | Performance Indicators |
| USAID | U.S. Agency for International Development |
| TEU | Twenty foot equivalent units |
| TOS | Terminal Operation System |

# INTRODUCTION

This purpose of this User Manual is to provide guidance on defining methods and processes of compiling data on the operations of Cap Haitien Port (CHP) container terminal and the respective calculations of a set of recommended performance indicators (PIs). The manual identifies the data requirements for each indicator, the source of these data items, the forms to be used for compiling these items, and the formulas for calculating the various indicators. It also discusses the necessary procedures for Autorité Portuaire Nationale of Haiti (APN) staff to fulfil their regulatory functions related to monitoring port operational performance. This manual is accompanied by an Excel-based spreadsheet and complement's the CHP Regulatory Strengthening Project's *Practical Guide and Tool for Monitoring Port Performance.*

As described in that report, when a private-sector terminal operator holds a monopoly position and is not be subjected to competitive influences, the government must impose minimum performance standards outlined within the concession contract to ensure a reasonable level of service and productivity in the terminal.

In addition to imposing these standards, APN is also interested in monitoring other dimensions of operations not under the terminal operator's control or not necessarily addressed within the contract's performance provisions. Such monitoring can be used for benchmarking against prior years' performance or against rival or best practice operators in other ports, or for planning purposes to prepare for capacity expansion.

Our main recommendation in the *Practical Guide and Tool* was that due to the unique circumstances of CHP, APN should be actively monitoring the operations of the CHP container terminal and, in fact, all of its container terminals. Accordingly, we suggested that the terminal operator(s) should provide APN with detailed operational data to enable APN to calculate a detailed list of indicators – well beyond the two indicators included in the draft concession contract. More specifically, we suggested that the operator provides APN with three operations reports encompassing the main operations of container terminals, including:

- *Vessel Operation Report;*
- *Gate Operation Report; and*
- *Yard Operation Report.*

This does not mean, however, that the operator will have to manually prepare and submit signed, hard-copies of these reports to APN. The draft contract mandates that the future CHP terminal will be managed via computerized terminal operating system (TOS), and most computerized TOS automatically generate these reports. Moreover, modern TOSs allow the terminal operator to share these reports "live" with APN (and others) via Electronic Data Interchange. This report takes the provision of a TOS as a given and assumes that much of the required data will come from the TOS.

The following chapters:

- Provide illustrative examples of calculating performance indicators; and
- Describe the procedures that APN should follow in fulfilling its regulatory functions.

# 1. ILLUSTRATIVE EXAMPLES OF CALCULATING PERFORMANCE INDICATORS

In this section, we further detail the technicalities of compiling operational data and calculating the performance indicators (which were further detailed in the *Practical Guide and Tool*). The accompanying Excel file includes simple forms to collect relevant data and to calculate the indicators. The forms are populated with a simple numerical example for illustration purposes.

A typical container terminal can be depicted as a stock and flow system with two flows: one through the berth and the other through the gate moving boxes into or out of a common stock, or a storage yard. In accordance with this depiction, we first discuss the two flows, or the berth and gate operations and their respective indicators, and then the stock and the container yard operations and respective indicators.

Table 1 presents the main data items related to CHP terminal operations to be collected, compiled and submitted to APN, along with the related performance indicators (PIs) calculated based on these items.

**Table 1. Data Items and Performance Indicators**

| No. | Data Item/Indicator | Description | Unit of Measure |
|---|---|---|---|
| 1 | Port Time | Buoy-In to Buoy Out | Hours |
| 2 | Berth Gross Time | First Line to Last Line | Hours |
| 3 | Berth Work Time | First Box to Last Box | Hours |
| 4 | Crane Work Time by Crane Type | First Box to Last Box | Hours |
| 5 | Call Size | Number of Moves | Moves |
| 6 | Crane Net Productivity by Crane Type | Moves/Work Time | Moves/Hour |
| 7 | Berth Net Productivity | Moves/Work Time | Moves/Hour |
| 8 | Berth Gross Productivity | Work Time/Berth Time | Moves/Hour |
| 9 | Berth Utilization | Total Berth Gross Time/Available Time | Percent |
| 10 | Truck Turn Time by Transaction Type | Wait + Terminal Time | Minutes |
| 11 | Yard Utilization by Box Type | Occupied/Capacity Slots | Percent |

| | | | |
|---|---|---|---|
| 12 | Dwell Time by Box Type | Time Unload to Pickup | Days |

The first eight data items and the following three performance indicators based on them refer to each ship call. The other items refer to daily reports. The set of data items and indicators included in the table above are well beyond those specified in the draft container terminal concession contract, which only included monthly averages of Crane Productivity and Truck Turn-Around Time. Our suggestion for an expanded monitoring system is in line with our view of the future APN acting as an "involved landlord". Accordingly, we consider the indicators listed here as an effective tool, assisting APN in fulfilling its three roles of regulation, administration and planning. The two PIs in the contract are only monthly averages—which provide limited insight, if any, into CHP operations. We follow below with examples of each of Table 1's indicators.

# BERTH PERFORMANCE INDICATORS

## Crane and Vessel Operation Report

The Berth Net Productivity PI is equal to the Crane Net Productivity indicator in situations like that expected at CHP where ships are only working with a single MHC. However, it could well be that in the future additional MHCs and/or ships' cranes will be deployed for ship handling. In this case, the Crane Net Productivity indicator will have to be separated from Berth Net Productivity indicator. Separate data on Crane Net Productivity indicators would also have to be collected according to the different types of cranes serving ships at CHP (for example, separately for MHC, ship's gears, and gantry cranes if applicable). Hence, for illustration and training purposes, we present below two separate reports, a Crane Operation Report and a Vessel Operating Report, even though under present conditions they would be one in the same at CHP.

Typically the Crane Operation Report is part of the Vessel Operating Report. For clarity, the two reports are presented using a simple format and a simple case of ship handling as a numerical example. Figure 1 shows a typical Vessel Operation Report form, taken from a major regional terminal. The sample form includes all the data items and performance indicators included in Table 1. For simplicity, we decided to present here a more rudimentary version of the Vessel Operation Report along with a preliminary form of a Crane Operation Report (Figure 2).

Figure 2's Crane Operation Report describes the operation of a single crane. Operation times included in this report and in the Vessel Operation Report usually are provided by the terminal operator. These times are taken from a log-book of the checker (tallyman, clerk) stationed on the dock nearby the crane. In most modern terminals checkers use hand-held tablet computers for reporting, whereby to each event the computer automatically attach clock time.

Note that Figure 2 is a simple form for collecting and analyzing operational data of the activities of a single crane (or gang) during one shift. The form is incorporated as one column in the Vessel Operation Report. The basis for the report is a time-log, describing the main events

during the handling process of a vessel by a single crane, including their clock (continuous) times and performance, mainly the number of moves or other activities (or idling). The clock times are recorded at the end of each event which often includes a group of related activities such as discharging the 25 boxes stowed in Bay 1. For simplicity, the selected example only includes 10 events, depicting the handling of 100 moves (boxes), located in 2 bays. Section II. Crane Time Log & Activity of the Vessel Operation Report includes the times, activities and events during the ship-handling process of each crane. The clock time and number of moves are presented in black and the calculated data and indicators in red; explanations of the indicators calculations are in blue.

**Figure 1. Vessel Operations Report**

*I. General*

| | |
|---|---|
| Ship Name | Hope |
| Crane Number | MHC 1, Ship |
| Date | 17-Jul-17 |
| Shift | Day |

*II. Ship's Time Log*

| | Description | Clock | Elapsed |
|---|---|---|---|
| | Arrival at Buoy | 5:00 | |
| 1 | Wait for Pilot | 5:30 | 30 |
| 2 | First Line | 6:00 | 30 |
| 3 | First Box | 7:30 | 90 |
| 4 | Last Box | 15:00 | 450 |
| 5 | Last Line | 15:45 | 45 |
| 6 | Departure Buoy | 16:00 | 15 |
| | Total | Minute | 660 |
| | | Hour | 11.00 |

*III. Crane Activity*

| Description | Crane Number | | Total |
|---|---|---|---|
| | MHC 1 | Ship 1 | |
| Crane Net-WorkTime | 6.25 | 5.00 | 11.25 |
| *Unavoidable Delays* | 0.75 | 1.00 | 1.75 |
| Crane Time | 7.00 | 6.00 | 13.00 |
| *Avoidable Delays* | 1.00 | 2.00 | 3.00 |
| Crane Gross Time | 8.00 | 8.00 | 16.00 |
| *Total Moves* | 100 | 90 | 190 |
| Crane Net-Work Productivity | 16.00 | 18.00 | 16.89 |
| Crane Net Productivity | 14.29 | 15.00 | 14.62 |
| Crane Gross Productivity | 12.50 | 11.25 | 11.88 |

*III. Analysis*

*Time Breakdown:*

| | | |
|---|---|---|
| Berth Work Time | 7.50 | = 15:00 - 7:30 |
| Berth Occupied Time | 8.25 | = 15:45 - 7:30 |
| Port Time | 11.00 | = 16:00 - 5:00 |
| Port Access Time | 2.75 | = 11.00 - 8.25 |

*Performance Indicators:*

| | | |
|---|---|---|
| Berth Net Productivity | 25.33 | = 190 / 7.50 |
| Berth Gross Productivity | 23.03 | = 190 / 8.25 |

**Figure 2. Crane Operations Report**

*I. General*

| | |
|---|---|
| Ship Name | Hope |
| Crane Number | MHC 1 |
| Date | 17-Jul-17 |
| Shift | Day |

*II. Crane Time Log & Activity*

| | Description | Time (min.) | | | | | Import | | Export | | Total | Prod. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Clock | Elapsed | Work | Delays | | 20 | 40 | 20 | 40 | Moves | |
| | | | | Net | Unavoidable | Avoidable | Moves | Moves | Moves | Moves | Moves | Moves/Hr |
| | Gang Onboard | 7:00 | | | | | | | | | | |
| 1 | Wait for Crane | 7:30 | 30 | | | 30 | | | | | | |
| 2 | Open Hatch 1 | 7:40 | 10 | | 10 | | | | | | | |
| 3 | Unload - Bay1 | 9:00 | 80 | 80 | | | 15 | 10 | | | 25 | 18.75 |
| 4 | Close Hatch 1 | 9:10 | 10 | | 10 | | | | | | | |
| 5 | Move Crane | 9:20 | 10 | | 10 | | | | | | | |
| 6 | Unload - Bay 2 | 11:45 | 145 | 145 | | | 25 | 20 | | | 45 | 18.62 |
| 7 | Crane Breakdown | 12:15 | 30 | | | 30 | | | | | | |
| 8 | Load - Bay 2 | 14:00 | 105 | 105 | | | | | 8 | 10 | 18 | 10.29 |
| 9 | Move Crane | 14:15 | 15 | | 15 | | | | | | | |
| 10 | Load - Bay 1 | 15:00 | 45 | 45 | | | | | 12 | | 12 | 16.00 |
| | Total | Minute | 480 | 375 | 45 | 60 | 40 | 30 | 20 | 10 | 100 | --- |
| | | Hour | 8.00 | 6.25 | 0.75 | 1.00 | | | | | | |

*III. Analysis*

*Time Breakdown:*

| | |
|---|---|
| Crane Net-WorkTime | 6.25 |
| *Unavoidable Delays* | 0.75 |
| Crane Time | 7.00 |
| *Avoidable Delays* | 1.00 |
| Shift Time | 8.00 |

*Performance Indicators:*

| | | |
|---|---|---|
| Crane Net-Work Productivity | 16.00 | = 100 / 6.25 |
| Crane Net Productivity | 14.29 | = 100 / 7.00 |
| Crane Gross Productivity | 12.50 | = 100 / 7.75 |
| Crane Time / Shift Time | 88% | =7.00 / 8.00 |

As seen in the simple example included in Figure 2, the crane productivity varies during the handling process according to type of activity. Usually, unloading (discharge) is faster than loading and handling deck boxes is faster than handling hatch boxes. Section III. Analysis, Time Breakdown of the figure includes a summary of the elapsed times grouped according to 3 types of activities:

- Working – Box handling;
- Unavoidable Delays -- Open & close hatch-covers, move crane to/away from vessel and alongside dock, changing spreaders, bad weather, etc.; and
- Avoidable Delays -- Late arrival of labor, breakdown of equipment, waiting for orders, waiting for boxes, etc.

Figure 2's Section III. Analysis, Performance Indicators includes a calculation of four indicators, based on data already compiled in other sections of the report. The indicators include three levels of crane productivities along with an indicator related to crane's time utilization. The Crane Net-Work Productivity and Crane Time / Shift Time are not included in the list of indicators recommended included in Table 1. Nevertheless, we suggest to collect and compile these indicators because of the important insight they convey.[1]

Figure 1's Vessel Operations Report illustrates a simplified version of this common form used for collecting and analyzing operational data of all cranes involved in the handling process of a vessel, during the entire time of stay at CHP. Ships times (e.g., buoy arrival time) are sourced from external parties (e.g., Port Captain or ship agent). It is suggested that the future CHP's operator will also be required to obtain these data items and input them to the Vessel Operations Report. Another, more advanced option, is that these data items will be directly fed into the TOS by the Port Captain via electronic data interchange.

Figure 1's Section II. Ship's Time Log includes the clock and elapsed times of the main events during the ship stay at the port. Section III. Crane Activity is similar to the same section in the Crane Operation Report, with the activities of each crane described in a summary format using a single column. For simplicity, the specific example included in Error! Reference source not found. assumes that the ship stays only one shift, during which it is served by two cranes, a MHC and a shipboard crane. Section III. Analysis includes a summary of the main times and calculation of indicators for the entire ship, based on the two cranes that served it, the Gross and Net Berth Productivity. As shown in the Figure, the time-related calculations are in red and explanations for the Time Breakdown and indicators section are in blue.

As seen in the Figure 1 example, the total time that the ship spends in CHP, from arriving at the entrance buoy until departing, defined as Port Time, extended 11.00 hours, of which the time the ship was tied to the berth, defined as Berth Occupied Time (First line to Last Line), is 8.25

[1] For example, the Crane Net-Work Productivity is most comparable regarding crane-operator proficiency, since it excludes delays over which the crane operator has no control.

hours and the time during which the cranes were involved in ship handling, defined as Berth Work Time (First Box to Last Box) was 7.50 hours. Of special interest is the Port Access Time, defined as ship's time spent on maneuvering and, mostly, ship's waiting for berth, pilot, tug and other avoidable delays which, in our case, is 2.75 hours. The call size or the number of boxes handled by the 2 cranes is 190; crane MHC 1 handles 100 moves and the ship-crane 90 moves. It should be noted that the operational unit is a move (box, container) and not TEU and that the reporting does not differentiate between various types of boxes (full, empty, dry, etc.).

## Periodic Summaries

The operational data per ship will be aggregated into a monthly report, including data on Berth Net and Gross Productivities, Berth Work Time, Berth Gross Time and Port Time. The monthly report is a simple list, with each ship's data appears in one row. The form will provide for calculating the monthly averages, including that of Net Berth Productivity, the equivalent to the crane productivity indicator required by the Contract. The summary monthly report could be provided by using a common spreadsheet program, identifying high and low performances for the month and overall. The program will allow, using regression, to quantify the relations between productivity and ship size, call size, shipping line, etc. The analysis also could flag outliers according to pre-determined criteria, drawing the attention of the terminal operator and APN and provide for the generation of graphical dashboard.

Another indicator that should be calculated on a monthly basis is:

***Berth Utilization*** (%) = Total Berth Gross Time / Available Time

Where

*Available Time* = Calendar Time – Holidays – Bad Weather

Berth utilization is an important determinant of both ship's waiting for berth and the overall capacity utilization of the terminal and should be closely monitored by APN as part of both its regulatory and planning role.

# GATE PERFORMANCE INDICATORS

Figure 3 shows a simple form for daily collection and analysis of data on gate activities. The activities are arranged according to trucks arrival time and include a time-log of all gate transactions and activities in which the truck (or driver) is involved during its stay at the terminal. The proposed report provides for allocating elapsed times according to 8 types of transactions, pre-gate waiting and no transaction, defined as Problem. The 8 transactions include:

- 4 single transactions:
  - Full-In,
  - Full-Out,
  - Empty-In, and

  - Empty-Out; and
- 4 double transactions:
  - Full-In+Full Out,
  - Full-In+Empty Out,
  - Empty In+ Full Out, and
  - Empty-In+Empty-Out.

The last transaction, involving empty boxes moving in opposite directions, relates to either different types of boxes or boxes belonging to different shipping lines. Since a typical 40-ft chassis can carry either one 40-ft or two 20-ft boxes the gate transactions can also be differentiated by the number of boxes. E.g., the Full-In could relate to a single 40-ft or two 20-ft, with the second one includes an additional gate inspection and yard lift, resulting in a longer turn time. The clock time (log) recording for each transaction relates to 3 times:

***Arrival Time*** = The time that the truck driver presents his documents at the pre-gate office after parking his truck at the parking lot outside the gate;

***Gate-In Time*** = The time that the actual transaction at the gate **begins,** with the truck on its way into the terminal; and

***Gate-Out Time*** = The time that the actual transaction at the gate **ends,** with the truck on its way out of the terminal.

**Figure 3. Gate Operations Report**

Gate Operations Daily Report

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | 3-Jul-17 | | | | | | | | | | | | | | | | Open | 7:00 |
| | Gate Open | 7:00:00 AM | | | | | | | | | | | | | | | | Close | 19:30 |
| | Gate Close | 7:00:00 PM | | | | | | | | | | | | | | | | | |
| | Truck Number | Clock Times | | | Elapse Times (Min) | | Boxes | | | | Transactions Time (Min) | | | | | | | | |
| | | Arrive | In | Out | In - Arrive | Out - In | Full-In | Full-Out | Mty-In | Mty-Out | Full In | Full Out | Full In + Full Out | Full In + Empty Out | Empty In | Empty In + Full Out | Empty Out | Empty In + Empty Out |
| 1 | 12345ABC | 7:00:00 AM | 7:10:00 AM | 8:00:00 AM | 10 | 50 | 1 | | | | 50 | | | | | | | |
| 2 | | 9:03:00 AM | 9:05:00 AM | 10:00:00 AM | 2 | 55 | | 1 | | | | 55 | | | | | | |
| 3 | | 11:00:00 AM | 11:30:00 AM | 12:00:00 PM | 30 | 30 | | | | 1 | | | | | | | 30 | |
| 4 | | 11:09:00 AM | 11:30:00 AM | 1:15:00 PM | 21 | 105 | 2 | | | 2 | | | | 105 | | | | |
| 5 | | 12:00:00 PM | 2:40:00 PM | 5:00:00 PM | 160 | 140 | | 1 | 1 | | | | | | | 140 | | |
| 6 | | 2:00:00 PM | 2:40:00 PM | 3:00:00 PM | 40 | 20 | | 1 | | | | 20 | | | | | | |
| 7 | | 3:00:00 PM | 3:00:00 PM | 5:59:00 PM | 0 | 179 | | 1 | 1 | | | | | | | 179 | | |
| 8 | | 4:00:00 PM | 4:30:00 PM | 5:00:00 PM | 30 | 30 | | | 1 | | | | | | 30 | | | |
| 9 | | 5:00:00 PM | 6:30:00 PM | 7:00:00 PM | 90 | 30 | | | | 1 | | | | | | | 30 | |
| 10 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 11 | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | |
| | | Number of Transactions | | | 9 | 9 | 2 | 4 | 3 | 3 | 1 | 2 | 0 | 1 | 1 | 2 | 2 | 0 |
| | | Total Time | | | 383 | 639 | 3 | 4 | 3 | 4 | 50 | 75 | 0 | 105 | 30 | 319 | 60 | 0 |
| | | Average Time | | | 43 | 71 | | | | | 50 | 38 | - | 105 | 30 | 160 | 30 | - |

The daily gate report will be aggregated on a monthly basis and monthly average times per transaction calculated, along with an overall average for all transactions as required by the Contract. Since, as noted in Report I, most of the gate information is collected as required by the International Ship and Port Facility Security (ISPS) convention, the preparation of this report should not add much work to the terminal operator. The Gate Operation Report can be automatically generated by the computerized TOS.

The Contract only requires the calculation of a single performance indicator related to a monthly, all-average, truck turn time. We suggest to expand the Contract requirement to include a breakdown by transaction type and the pre-gate waiting time. Since CHP does not have pre-gate parking, it is suggested that the driver will walk to the gate to record their arrival times. Alternatively, though less reliably, this information could be compiled through dispatchers of truck companies.

Accordingly, our suggested PIs include:

***Truck Turn Time*** (minutes) – The average time per truck per transaction type since starting the gate-in process until completing the gate-out one; and

***Truck Waiting (Pre-Gate) Time*** (minutes) – The average time per truck since arriving at the gate-in until starting the gate-in process.

We also suggest to provide statistics about the failed transaction ("problems" or "trouble cases"), including incidence (% of completed transaction) and description of the reasons (problems with Delivery Orders, Customs Release, etc.).

In addition to averages, a more in-depth analysis should include a time distribution of the various transactions, focusing on flagging out outliers. The distribution of gate transactions should also be by the hour of the day, days of the week, etc., in order to identify peak or idle periods.

CHP has only one gate, serving both full and empty containers with no differentiation between lanes. Larger terminals may have separate lanes for full and empty or even a special gate for empty trucks. This arrangement allows for trucks leaving the terminal with no containers (e.g., after dropping off a full or empty box) to avoid waiting in line in the general gate.

## YARD PERFORMANCE INDICATORS

The yard performance indicators are more relevant to the administrative and planning roles of APN and less for its regulatory role. Still, the yard performance affects that of both the berth and gate, including their respective PIs in the Contract. Therefore, although no data on yard performance is required by the Contract, we suggest including such requirement, along with calculations of related indicators. The yard data and indicators relate to the number of boxes stored inside the terminal ("inventory"), the utilization of storage capacity and, separately, the dwell times of these boxes.

Figure 4 shows a simple form for the daily collection and analysis of yard inventory and the calculation of performance indicators related to storage capacity utilization. The daily inventory report includes the number of boxes stored in the terminal at a certain time (usually at the end of the previous day), categorized by box type (dry/reefer, full/empty). Sometimes the full (loaded) boxes are further categorized by direction (import/export).[2] As noted several times in our discussion thus far, the suggested form included in the figure below is for illustration

[2] A similar, but more detailed inventory report, is provided by the terminal operator to each of the shipping lines regarding their own boxes.

purposes. In reality there is no need for such a manual report or even any hardcopy report, since the computerized TOS usually provides the data "live". The suggested form in Figure 4 is monthly, with each row describing a day. All the figures in this report are in TEUs. The report includes three sections for compiling traffic data: Inventory, Berth and Gate. Positive numbers represent in-flows or traffic which increases the inventory and vice-versa. The Inventory column relates to the number of boxes (in TEUs) stored inside the yard at the beginning of the day, which is equal to that at the beginning of the previous day with the daily traffic through the berth and the gate added or subtracted. The Space Utilization section includes the storage capacity of the yard for each type of box and the utilization is calculated by simply dividing the respective inventories by their storage capacity.

**Figure 4. Yard Performance Summary Report**

| Date | Capacity | | Inventory | | | | Berth | | | Gate | | | Utilization | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 200 | 30 | 500 |
| | Dry | Reefer | Total | Dry | Reefer | Empty | Dry | Reefer | Empty | Dry | Reefer | Empty | Dry | Reefer | Empty |
| Starting | 200 | 30 | 322 | 100 | 22 | 200 | 5 | -1 | 10 | 10 | 7 | -10 | 50.0% | 73.3% | 40.0% |
| 2/1/2017 | 200 | 30 | 350 | 120 | 30 | 150 | 10 | 5 | -20 | 5 | -6 | 10 | 60.0% | 100.0% | 30.0% |
| 2/2/2017 | 200 | 30 | 304 | 135 | 29 | 140 | -4 | 2 | 4 | -25 | -5 | 5 | 67.5% | 96.7% | 28.0% |
| 2/3/2017 | 200 | 30 | 281 | 106 | 26 | 149 | 1 | | | -10 | | | 53.0% | 86.7% | 29.8% |
| 2/4/2017 | 200 | 30 | 272 | 97 | 26 | 149 | 5 | | | 8 | | | 48.5% | 86.7% | 29.8% |
| 2/5/2017 | 200 | 30 | 285 | 110 | 26 | 149 | -8 | | | 2 | | | 55.0% | 86.7% | 29.8% |
| 2/6/2017 | 200 | 30 | 279 | 104 | 26 | 149 | 9 | | | 6 | | | 52.0% | 86.7% | 29.8% |
| 2/7/2017 | 200 | 30 | 294 | 119 | 26 | 149 | 6 | | | 9 | | | 59.5% | 86.7% | 29.8% |
| 2/8/2017 | 200 | 30 | 309 | 134 | 26 | 149 | 4 | | | 7 | | | 67.0% | 86.7% | 29.8% |
| .... | | | | | | | | | | | | | | | |
| 2/28/2017 | 200 | 30 | | | | | | | | | | | | | |
| Average | | | 327 | 127.5 | 29.5 | 145 | 3 | 3.5 | -8 | -10 | -5.5 | 7.5 | 63.8% | 98.3% | 29.0% |

Note: Dry and Reefer only include full boxes

The proposed performance indicator for the container yard performance relates to its monthly average inventory and slot-capacity utilization or per each type of box:

***Inventory*** (TEUs) = Average number of TEU in the yard

***Yard Utilization*** (%) = Average number of Occupied TEU-slot / Total TEU-slot

In addition to calculating monthly averages a statistical analysis should identify peak situations, whereby utilization approaches 100%, signaling a shortage of space and congestion. The utilization of the dry containers is usually of most interest since high utilization, commonly considered that exceeding 60 – 70% (pending on yard equipment), results in box shuffling and respective additional costs for box moving and truck waiting. Sometimes, the shuffling may delay vessel loading, especially while looking for export boxes.

A second performance indicator related to the yard operation is the average dwell time for boxes. This indicator is directly related to the indicator that measures inventory, since a longer dwell time increases the inventory. Analysis of long dwell times is especially revealing in the case of import boxes, including investigation of the underlying reasons and, perhaps, the need to take actions (removal to outside storage, condemnation, etc.).

***Average Dwell Time*** (days) = by type (reefer/dry) and direction (import/ export)

Unlike the data on yard inventory, data on dwell time ("aging") is difficult to compile manually. It requires a comprehensive database in which every container is registered along with a compilation of a succession of relevant events and times (e.g., for full imports: discharged from vessel, departed through the gate, brought back empty, etc.). However, most digitized TOSs generate aging reports, including flagging out outliers according to pre-determined criteria. It should be noted that dwell time is also important because of the storage fees related to it as discussed in the next session.

# 2. PROCEDURES FOR FULFILLING REGULATORY FUNCTIONS: MONITORING, ENFORCEMENT AND TAKING CORRECTIVE ACTIONS

The objective of the performance operating system and respective performance indicators is to support APN in its regulatory, administrative and planning roles. Outside of the two indicators in the draft contract, our additional proposed indicators are not enforceable and no sanctions are stipulated for not reaching their target values. The indicators proposed in our report are essentially a management tool that should assist APN, the terminal operator(s), port users, Customs and the entire port community in improving the performance of the port system. Accordingly, we suggest that APN will publish a monthly performance report with the indicator results compared to their target value for the community to review. This report is likely to attract much attention especially in such cases where results are unsatisfactory, in which case we suggest APN should lead a corrective effort, being the most senior participant in the port system.

It should be noted that the underlying causes for unsatisfactory results may not necessarily be attributed to the terminal operator. For example, unduly long port time of vessels could be the result of unavailability of pilotage and tug services during nights, failure of ship agents to communicate with APN or the terminal operator, delays in vessel clearance by Customs and Immigration, etc. Likewise, low berth productivity could be the result of interruption of the container activities by commercial activities. The envisioned role of APN is to identify and investigate these problems and initiate a collective effort to remedy them.

## DATA COLLECTION FORMS, PI CALCULATION AND DASHBOARD

It was previously indicated that almost all container terminals, including the future CHP terminal, employ computerized TOSs. Accordingly, the basic operations reports discussed in the previous chapter: Crane Operations Report, Vessel Operations Report, Gate Operations Report and

Yard Operations Report are automatically produced by TOS and can automatically accessed by the regulatory authority. The TOS, however, does not usually records operational events taking place **outside the terminals,** such as vessel arrival time, pilot-on-board, pre-gate waiting, etc. Some of these events are usually recorded by the maritime authority, or its local representative, the Port (Harbor) Captain, but others (e.g., trucks arrival time at the gate), are still not reported. It also should be noted that in the case of CHP, the container berth remains under the control of APN and is not part of the container terminal concession.

Altogether, while TOS is an important source of operational data, TOS usually also does not compile, summarize and calculate the full list of PIs in Table 1above required for performance monitoring and regulatory control. The following sections present and discuss three reports, summarizing the operations of the three main components of the container terminals: berth, gate and yard and are used for calculating the respective PIs. Each report is discussed in a separate section, including defining input data items, identifying sources for obtaining them, explaining the formula used in calculation of PIs and comparing calculated (actual) values to contract values (standards). A summary Dashboard Report includes an assembly of graphics illustrating the main PIs.

## Berth Performance Monthly Report

Figure 5 presents an example of a proposed form to compile monthly berth operations data, calculates respective PIs and compare the results to contract values. Each line in the Berth Performance Report refers to the performance during one vessel call with the information taken from Vessel Operations Report presented in Figure 1 above.

For illustration, Figure 5 includes hypothetical data for CHP during July 2017, summarizing the operations of 10 vessels. As seen in this figure, during July 2017 CHP had two liner services, each having a fixed-day-of-the-week schedule. The service with the larger call size, to which the vessel named Hope presented in Figure 1 belongs, was handled by two cranes: a Mobile Harbor Crane (MHC) and Ship's Crane (gear). The other service was only handled by a MHC. The monthly summary is included at the bottom of Figure 5, which also includes the comparison to the contract standards. Accordingly, in the hypothetical example here, the Gross Berth Productivity, the most important productivity indicator exceeds the standard by 0.69 moves/hour, while Net Berth Productivity is equal to the standard and Gross Crane Productivity 1.90 moves/hour below the standard. The example of the monthly report in Figure 5 does not differentiate between the two cranes; such differentiation can be added if deemed important. There also is the possibility of compiling two separate, per-service monthly reports.

Figure 5 also includes, in the lower section, a table for calculating the monthly berth utilization. With only two services, each staying about 10 hours at berth, the utilization is quite low at 13.4%.

**Figure 5. Berth Performance Monthly Report**

Berth Performance Monthly Report

| | Vessel Name | Arrival Date | Call Size (Moves) | Times (Hours) | | | | Productivities (Moves/Hour) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Port Time | Berth Gross | Berth Net | Crane Gross | Berth Gross | Berth Net | Crane Gross |
| | | | a | b | c | d | e | c / a | d / a | e /a |
| 1 | --- | 7/1/2017 | 92 | 10.00 | 8.50 | 7.00 | 7.00 | 10.82 | 13.14 | 13.14 |
| 2 | --- | 7/3/2017 | 165 | 10.50 | 9.75 | 8.86 | 20.41 | 16.92 | 18.62 | 8.08 |
| 3 | --- | 7/8/2017 | 85 | 8.95 | 7.61 | 6.26 | 5.50 | 11.18 | 13.57 | 15.45 |
| 4 | --- | 7/10/2017 | 150 | 9.17 | 6.88 | 6.50 | 22.41 | 21.82 | 23.08 | 6.69 |
| 5 | --- | 7/15/2017 | 88 | 9.78 | 8.31 | 6.84 | 5.80 | 10.59 | 12.86 | 15.17 |
| 6 | Hope | 7/17/2017 | 190 | 11.00 | 8.25 | 7.80 | 17.27 | 23.03 | 24.36 | 11.00 |
| 7 | --- | 7/22/2017 | 95 | 10.67 | 9.07 | 7.47 | 7.30 | 10.47 | 12.71 | 13.01 |
| 8 | --- | 7/24/2017 | 162 | 9.05 | 6.78 | 6.17 | 17.91 | 23.88 | 26.27 | 9.05 |
| 9 | --- | 7/29/2017 | 101 | 10.86 | 9.23 | 7.60 | 7.10 | 10.94 | 13.29 | 14.23 |
| 10 | --- | 7/31/2017 | 178 | 9.56 | 8.87 | 8.07 | 18.63 | 20.06 | 22.07 | 9.56 |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| | Total / Average | | 1,306 | 99.53 | 83.25 | 72.58 | 129.33 | 15.69 | 17.99 | 10.10 |
| | | | | | | | Contract Value | 15.00 | 18.00 | 12.00 |
| | | | | | | | Difference | **0.69** | **(0.01)** | **(1.90)** |

| | | |
|---|---|---|
| Calender Hours | 744.00 | = 31 x 24 |
| Berth Gross Hours | 99.53 | |
| Berth Utilization | 13.4% | = 99.53 / 744.00 |

A Berth Performance chart is included in the monthly Dashboard Summary, providing graphic representation of the numerical results. The chart is automatically generated if the attached Excel model is used for compiling and calculating PIs. The chart intends to facilitate the identification of exceptions, such as vessels with low productivities, large differences between product ivies, large differences between port time and gross berth time, etc. To analyze these cases, the regulator should have the option to link to the TOS and retrieve the specific Vessel Operations Report.

## Gate Performance Monthly Report

Figure 6 presents an example of a proposed form to compile monthly gate operations data, calculates respective PIs and compare results to contract values. Unlike the previous Berth Monthly Performance Report in which each line refers to a vessel call, the Gate Monthly Performance Report refers to each day of the month in which the gate was open. Accordingly, each line in the report is the bottom (summary) line of the Gate Daily Report. For example, the bottom lines (Average Time) of the Gate Daily Report (Figure 3). The performance data in both the daily and monthly report refers to the truck turnaround time recorded at the terminal gate for 8 separate types of transactions. In addition the report includes statistics on the pre-gate waiting time. The bottom line compares the actual results (recorded turnaround times) to the contract standards, calculate the difference in minutes and as percentage of the standards. As

seen from the hypothetical data included in Figure 6, in all but the Empty In + Empty Out, the actual times were shorter than the contract standard.

**Figure 6. Gate Performance Monthly Report**

Gate Performance Monthly Report

| | Date | Total Trucks | Wait | Full In | | Full Out | | Full In + Full Out | | Full In + Empty Out | | Empty In | | Empty In + Full Out | | Empty Out | | Empty In + Empty Out | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Num | Min | Num | Min | Num | Min | Num | Min | Num | Min | Num | Min | Num | Min | Num | Min | Num | Min |
| 1 | 7/1/2017 | | | | | | | | | | | 2 | 20 | | | 3 | 50 | | |
| 2 | 7/3/2017 | 9 | 43 | 1 | 50 | 2 | 75 | 0 | 0 | 1 | 105 | 1 | 30 | 2 | 125 | 2 | 60 | 0 | 0 |
| 3 | 7/4/2017 | 20 | 50 | 2 | 55 | 5 | 70 | 2 | 92 | 3 | 85 | 5 | 27 | 3 | 140 | 5 | 56 | 1 | 25 |
| 4 | 7/5/2017 | | | | | | | | | | | | | | | | | | |
| 5 | 7/6/2017 | | | | | | | | | | | | | | | | | | |
| 6 | 7/7/2017 | | | | | | | | | | | | | | | | | | |
| 7 | 7/8/2017 | | | | | | | | | | | | | | | | | | |
| 8 | 7/10/2017 | | | | | | | | | | | | | | | | | | |
| 9 | --- | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | |
| | Total | 29 | | 3 | | 7 | | 2 | | 4 | | 6 | | 5 | | 7 | | 1 | |
| | Average | 15 | 47 | | 53 | | 71 | | 92 | | 90 | | 34 | | 134 | | 79 | | 25 |
| | Contract | | 20 | | 35 | | 45 | | 60 | | 45 | | 20 | | 60 | | 20 | | 30 |
| | **Differ.** | | **27** | | **18** | | **26** | | **32** | | **45** | | **14** | | **74** | | **59** | | **(5)** |

A Gate Performance chart included in the monthly Dashboard Summary depicts the monthly averages of the turnaround times for each transaction along with its respective contract time. As seen in this chart, in the case of Empty In + Empty Outs, the blue bar depicting actual turnaround time is shorter than the orange bar depicting contract standard.

## Yard Inventory Monthly Report

Figure 4, discussed previously, includes the monthly summary data and related discussion. A related Yard Inventory chart is included in the Dashboard, depicting the storage capacity utilization rates for full containers, dry and reefer, and for empty containers.

**Figure 7. Yard Dwell Time Report**

Yard Dwell Time Report

| Container Type | Dwell Days | | | | | Total |
|---|---|---|---|---|---|---|
| | 1 - 3 | 4 - 7 | 8 - 15 | 16 - 30 | 31+ | |
| Import Dry | 32 | 45 | 11 | 9 | 5 | 102 |
| Export Dry | 9 | 3 | | | | 12 |
| Import Reefer | 6 | 2 | | | | 8 |
| Export Reefer | 1 | | | | | 1 |

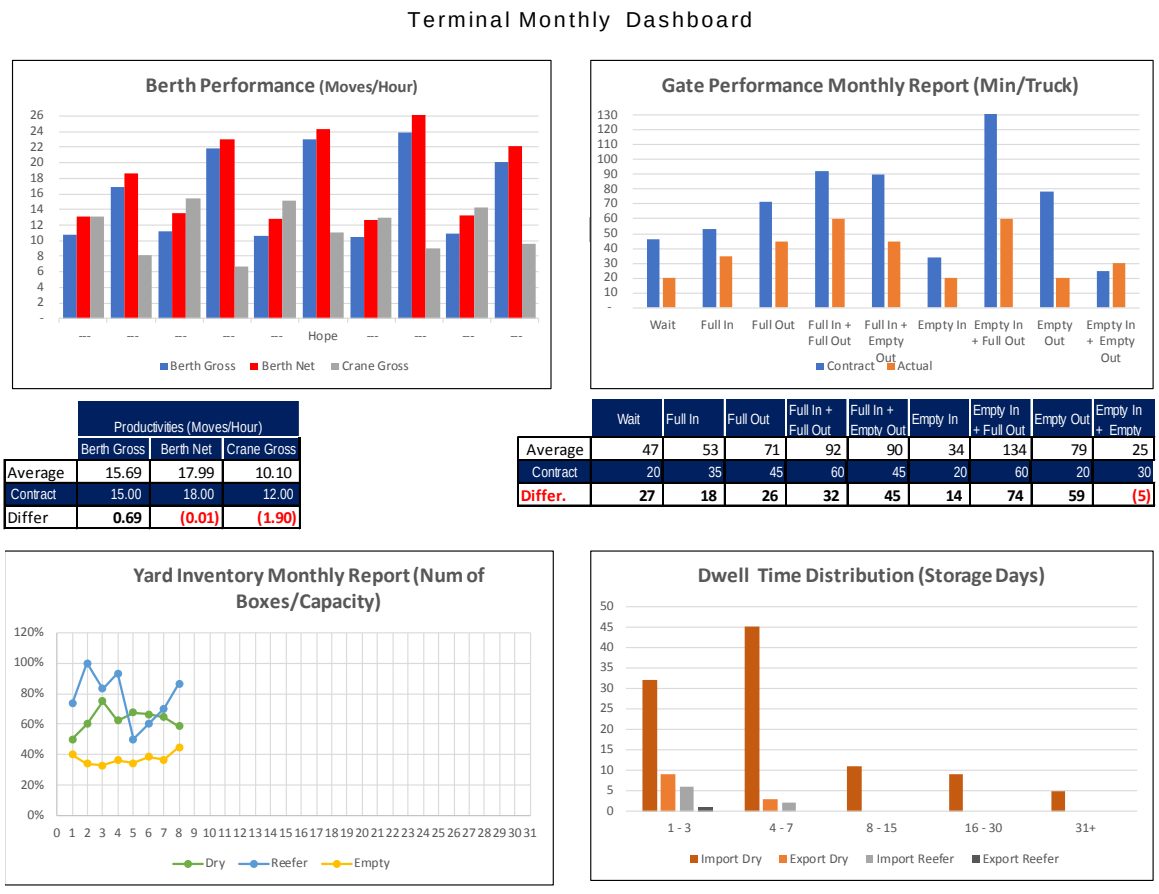
The other PI related to yard inventory is dwell time. The data, as previously discussed, is compiled by TOS. Figure 7 presents a typical dwell time distribution report, sometimes dubbed "aging report". Commonly, the report is produced once a month. The hypothetical data on dwell time provided at Figure 7, typical of most container terminals, indicates that:

- The dwell time of import boxes is higher than export ones, since export boxes are usually brought in close to vessel's arrival time (but not after the cut-off time, usually 24 hours prior to arrival);
- The dwell time of reefer boxes is short, especially for produce with short shelf life; and
- Most boxes are concentrated in the first category of dwell time, 1 – 3 days, which usually is the free (storage) time category.

## Monthly Dashboard

Figure 8 presents the monthly dashboard, a series of charts and tables providing a monthly summary of the performance of the main components of the container terminals: berth, gate and yard. The two tables included under the berth and gate performance charts are intended to facilitate contractual compliance, providing a comparison between the actual performance (monthly averages) and standard values specified in the concession contract. Incompliance is emphasized with red lettering through conditional formatting.

**Figure 8. Terminal Monthly Dashboard**




| | Productivities (Moves/Hour) | | |
|---|---|---|---|
| | Berth Gross | Berth Net | Crane Gross |
| Average | 15.69 | 17.99 | 10.10 |
| Contract | 15.00 | 18.00 | 12.00 |
| Differ | **0.69** | **(0.01)** | **(1.90)** |

| | Wait | Full In | Full Out | Full In + Full Out | Full In + Empty Out | Empty In | Empty In + Full Out | Empty Out | Empty In + Empty |
|---|---|---|---|---|---|---|---|---|---|
| Average | 47 | 53 | 71 | 92 | 90 | 34 | 134 | 79 | 25 |
| Contract | 20 | 35 | 45 | 60 | 45 | 20 | 60 | 20 | 30 |
| Differ. | **27** | **18** | **26** | **32** | **45** | **14** | **74** | **59** | **(5)** |