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Protection of Port and Yard Equipment's and Back to Operational Effectiveness under Abnormal Cyclonic Conditions

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Abstract: ***The purpose of this study is to assess the effect of the cyclones and its influence on port performance. The techniques of percentages and frequencies are applied to 141 cyclones as a sample, obtained from various cyclones happened around the world. The results identify and measure the factors that characterize the operational factors and affects port performance. Factors effecting including service level, partner network, ship services, cargo services, logistics services and advanced services, affect port performance, operational performance, effectiveness and efficiency. The primary contribution of this study deals with analysing the criticality of the cyclone and taking the appropriate measures, considering wind speeds ranging from 20 to 350 km/h. PYE (Port and Yard Equipment) which sub part of the equipment should be locked on safety measures and are more likely to get effected by the wind speeds and the sub equipment parts need to belocking considered are long travel, slew and boom conveyor.***

Keywords: ***port and yard Equipment's, stacker cum reclaimers, long travel, slew, boom Conveyor.***

I. INTRODUCTION

According to Indian meteorological department, ministry of earth science, government of India, the cyclone warnings are issued to state government officials in four stages.The First Stage warning known as "PRECYCLONE WATCH" issued 72 hours in advance contains early warning about the development of a cyclonic disturbance. The Second Stage warning known as "CYCLONE ALERT" is issued at least 48 hrs. in advance of the expected commencement of adverse weather over the coastal areas. The Third Stage warning known as "CYCLONE WARNING" issued at least 24 hours in advance of the expected commencement of adverse weather over the coastal areas. The Fourth Stage of warning known as "POST LANDFALL OUTLOOK" is issued by the concerned ACWCs/CWCs/and CWD at HQ at least 12 hours in advance of expected time of landfall.It gives likely direction of movement of the cyclone after its landfall and adverse weather likely to be experienced in the interior areas.

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The equipment's considered are

1. Ship unloaders
2. Ship loaders
3. Harbour mobile cranes
4. Stacker
5. Reclaimers
6. Stacker cum reclaimers
7. Wagon loader

Under abnormal cyclone conditions the storm anchoring locking devices kept ready in all aspects of equipment safety by means of safe parking positions including buffer end stopper locking, the evaluating criteria of how sever the wind speed will be the locking practices can be evaluated by which the respective equipment could be brought back in to operational effectively with in the minimum down time.

To minimize the sum of job waiting times,A branch and bound algorithm is proposed to solve the scheduling problem optimally [1]. The most important objective for a port container terminal is to increase its throughput or, in particular, to decrease the turnaround times of ships [2]. The major port operations and minimize the various delays [3]. The turnaround time of a ship depends on the effectiveness of allocating and scheduling key resources, such as berths, yards, quay cranes, yard cranes and trucks [4]. The problems faced by the Indian ports today[5].The average turnaround time could be cut down by 50%, India's manufacturing exports may increase by at least 20-25%. [6]

II. METHODOLOGY

A Different Cyclones around the World with Wind Speeds:

Studying different cyclones with varying wind speeds all the three sub parts of the equipment need not to be locked, depends on thecriticality of wind speeds locking arrangement can be considered to bring back to operational effectiveness

Considering the wind speeds with the interval of

The wind speeds taken from 20-110 being assigned as 1
The wind speeds taken from 110-200 being assigned as 2
The wind speeds taken from 200-350 being assigned as 3
With the class intervals respectively.

The following list is subdivided by basins. Data listed are provided by the official Regional Specialized Meteorological Centre,

1. North Atlantic Ocean
2. Eastern Pacific Ocean
3. Western North Pacific Ocean
4. North Indian Ocean

5. South-West Indian Ocean
6. Australian Region
7. South Pacific Ocean
8. South Atlantic Ocean

Table no.1: various cyclones with their names and occurrence of the year and wind speeds

S.No	Cyclone	Year	Wind Speed
1	South Atlantic	1974	45
2	Bapo	2015	65
3	Cari	2015	65
4	Deni	2016	75
5	Anita	2010	85
6	Arani	2011	85
7	Eçaí	2016	100
8	Catarina	2004	155
9	Bonita	1995–96	180
10	Marlene	1994–95	180
11	Hudhud	2014	185
12	Daniella	1996–97	190
13	Litanne	1993–94	190
14	Pakistan	1999	195
15	Floyd	2005–06	195
16	Giri	2010	195
17	Two	1963	195
S.No	Cyclone	Year	Wind Speed
18	Geralda	1993–94	200
19	Theodore	1993–94	200
20	Andhra Pradesh	1977	205
21	Beni	2002–03	205
22	Betty	1987	205
23	Carina	2005–06	205
24	Dovi	2002–03	205
25	Forrest	1983	205
26	Fran	1991–92	205
27	Gay	1992	205
28	George	2006–07	205
29	Glenda	2005–06	205
30	Guillaume	2001–02	205
31	Holly	1987	205
32	Hope	1979	205
33	Mahina	1899	205
34	Marge	1983	205
35	Nepartak	2016	205
36	Nilofar	2014	205
37	Oscar	1982–83	205
38	Peggy	1986	205
39	Sanba	2012	205
40	Zeb	1998	205
41	Chris-Damia	1981–82	210
42	BOB 02	1994	215
43	India	2001	215
44	Bento	2004–05	215
45	Chapala	2015	215
46	Dina	2001–02	215
47	Erica	2002–03	215
48	Fay	2003–04	215
49	Haima	2016	215
50	Heta	2003–04	215
51	Hondo	2007–08	215
52	Kalunde	2002–03	215
53	Meena	2004–05	215
54	Olaf	2004–05	215
55	Phailin	2013	215
56	Ruth	1991	215
57	Sidr	2007	215
58	Soudelor	2015	215
59	Ului	2009–10	215
60	Vance	1998–99	215
61	Vongfong	2014	215
62	Abby	1983	220
S.No	Cyclone	Year	Wind Speed
63	Adeline-Juliet	2004–05	220
64	Bansi	2014–15	220
65	Bruce	2013–14	220
66	Dot	1985	220
67	Edzani	2009–10	220
68	Elsie	1981	220
69	Flo	1990	220
70	Gwenda	1998–99	220
71	Hary	2001–02	220
72	Hina	1984–85	220
73	Hudah	1999–2000	220
74	Mac	1982	220
75	Meranti	2016	220
76	Odile	2014	220
77	Rita	1978	220
78	Vanessa	1984	220
79	Wynne	1980	220
80	Yuri	1991	220
81	Andhra Pradesh	1990	230
82	Amy	1979–80	230
83	Bess	1982	230
84	Eunice	2014–15	230
85	Gafilo	2003–04	230
86	Gay	1989	230
87	Gloria	1985	230
88	Graham	1991–92	230
89	Haiyan	2013	230
90	Hellen	2013–14	230
91	Joan	1975–76	230
92	Megi	2010	230
93	Percy	2004–05	230
94	Ron	1997–98	230
95	Susan	1997–98	230
96	Winston	2015–16	230
97	Bangladesh	1991	240
98	Gonu	2007	240
99	Inigo	2002–03	240
100	Opal	1995	240
101	Three	1963	240
102	Zoe	2002–03	240
103	Bahamas	1929	250
104	Fantala	2015–16	250
105	Floyd	1999	250
106	Igor	2010	250
S.No	Cyclone	Year	Wind Speed
107	Monica	2005–06	250
108	Orson	1988–89	250
109	Pam	2014–15	250
110	Paradip	1999	260

111	Ava	1973	260
112	Celia	2010	260
113	Elida	2002	260
114	Gilma	1994	260
115	Guillermo	1997	260
116	Hattie	1961	260
117	Hernan	2002	260
118	Hugo	1989	260
119	Ioke	2006	260
120	Marie	2014	260
121	Tip	1979	260
122	Cuba	1924	270
123	Isabel	2003	270
124	Ivan	2004	270
125	Kenna	2002	270
126	Cuba	1932	280
127	Andrew	1992	280
128	Camille	1969	280
129	David	1979	280
130	Dean	2007	280
131	Janet	1955	280
132	Katrina	2005	280
133	Mitch	1998	285
134	Rick	2009	285
135	Rita	2005	285
136	Labor Day	1935	295
137	Gilbert	1988	295
138	Linda	1997	295
139	Wilma	2005	295
140	Allen	1980	305
141	Patricia	2015	345

Source:
Atlantic Hurricane Best Track File 1851–2016
East Pacific Hurricane Best Track File 1851–2016
Typhoon information for theWestern Pacific ocean
Tropical Cyclone Best Track Information for the North Indian Ocean 1851–2016[
"TCWC Wellington Best Track Data 1967–2006
"Second only south Atlantic tropical storm: 90Q, moving away from Brazil".

B CATEGORZATION OF WIND SPEEDS

The wind speeds ranges been segregated in to three categories given in Table no.2 and equipment sub parts locking being assigned for safety values to the labels under abnormal cyclonic conditions.

Table no.2: Categorization of wind speeds

Wind Speed	Sub-parts (Safety Labels)	Safety Values
20-110	long travel	1
110-200	long travel and slew	2
200-350	long travel, slew and boom conveyor	3

From the table no.1 data of cyclones with wind speeds being put in ascending order and assigned the values of wind speed ranges as below

Table no.3: Ascending order of wind speeds from table no.1

S.No	Wind Speed	Safety
1	45	1
2	65	1
3	65	1
4	75	1
5	85	1
6	85	1
7	100	1
8	155	2
9	180	2
10	180	2
11	185	2
12	190	2
13	190	2
14	195	2
15	195	2
16	195	2
17	195	2
18	200	2
19	200	2
20	205	3
21	205	3
22	205	3
23	205	3
24	205	3
25	205	3
26	205	3
S.No	Wind Speed	Safety
27	205	3
28	205	3
29	205	3
30	205	3
31	205	3
32	205	3
33	205	3
34	205	3
35	205	3
36	205	3
37	205	3
38	205	3
39	205	3
40	205	3
41	210	3
42	215	3
43	215	3
44	215	3
45	215	3
46	215	3
47	215	3
48	215	3
49	215	3
50	215	3
51	215	3
52	215	3
53	215	3
54	215	3
55	215	3
56	215	3
57	215	3
58	215	3
59	215	3
60	215	3

61	215	3
62	220	3
63	220	3
64	220	3
65	220	3
66	220	3
67	220	3
68	220	3
69	220	3
70	220	3
71	220	3
72	220	3
73	220	3
74	220	3
75	220	3
76	220	3
77	220	3
78	220	3
S.No	Wind Speed	Safety
79	220	3
80	220	3
81	230	3
82	230	3
83	230	3
84	230	3
85	230	3
86	230	3
87	230	3
88	230	3
89	230	3
90	230	3
91	230	3
92	230	3
93	230	3
94	230	3
95	230	3
96	230	3
97	240	3
98	240	3
99	240	3
100	240	3
101	240	3
102	240	3
103	250	3
104	250	3
105	250	3
106	250	3
107	250	3
108	250	3
109	250	3
110	260	3
111	260	3
112	260	3
113	260	3
114	260	3
115	260	3
116	260	3
117	260	3
118	260	3
119	260	3
120	260	3
121	260	3
122	270	3
123	270	3
124	270	3
125	270	3
126	280	3
127	280	3
128	280	3
129	280	3
130	280	3
S.No	Wind Speed	Safety
131	280	3
132	280	3
133	285	3
134	285	3
135	285	3
136	295	3
137	295	3
138	295	3
139	295	3
140	305	3
141	345	3

Table no. 4: percentages and Frequency Table of equipment subparts locking.

Safety	Occurrence	Cumulative
Long Travel	7 (5.0%)	7 (5.0%)
Slew Lock	12 (8.5%)	19 (13.5%)
Boom Conveyor	122 (86.5%)	141 (100%)

Within the Parenthesis value indicates the safety percentages of equipment subparts.

At a class interval of 20 to 110 km/h wind speeds along travel can be locked, simultaneously with the increase intensity of wind speed 110 to 200 km/hr combination of long travel and slew can be locked, similarly in a progressive rapidly seemingly manner at 200 to 350 km/hr component elements of individually distinct long travel, slew and boom conveyor can be locked together. Wise considering the three class intervals the re-operational effective turnaround time is drastically reduced by a shift time or so.

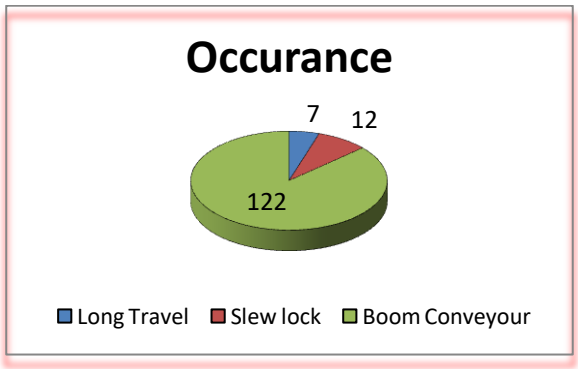

Fig. 1: Under abnormal cyclonic conditions locking of equipment sub parts at various wind speeds

All the three sub parts of the equipment's mentioned need not to be locked with the cyclone alert the locking arrangements be considered with the criticality of wind speeds and the intensity of rain due slides of cargo can enter in to long travel boogies, hence with the alert of cyclones equipment's can be kept at parking positions and boom can be rested for equipment safety and other parameters be considered by studying the cyclone on dated of occurrence.

III. RESULTS AND DISCUSSIONS

1. For port and yard equipment's locking arrangements can be done by analysing the criticality of cyclones with their directions and wind speeds periodically considering the facts of operational hampering.
2. Initially Boom can be locked under cyclonic alerts, thereby minimizing down time and getting back the respective equipment's to operations, hence reducing turnaround time of the vessel under theses abnormal conditions also.
3. Boom conveyor locking helps the equipment in tact with in the parking premises, by which fouling with other super structure / vessel hatch considerations.

IV. CONCLUSION

This study is made for protecting the port and yard equipment's by using various safety features and the equipment safety and getting back the equipment in to operational effectiveness with in the minimum turnaround time.

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