

Effect of platform robustness on inspection planning

Prepared by **EQE International Limited** for the Health and Safety Executive 2004

RESEARCH REPORT 246



Effect of platform robustness on inspection planning

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Offshore platforms require inspection of the underwater portion of the structure on a regular basis. A "robust" structure has inherent redundancies in terms of alternative load paths around any damaged areas and adequately proportioned alternative member strength that allow it to withstand global damage caused by ship impact, fatigue cracking, extreme storms, dropped objects, and other events. Therefore, robust structures may not need as much inspection as other structures, since they are less vulnerable to damage.

Ultimate strength analysis is critical for understanding and defining robustness. Ultimate strength analysis determines the reserve and residual strength, the redundancy and global failure mechanism of the jacket.

EQE has one of the largest in-house data of ultimate strength analyses available, with over 190 pushovers on 65 specific platforms analyzed from around the world. Using this dataset as a basis for investigation, the Health and Safety Executive (HSE) tasked EQE International, Inc. (EQE) to study how platform robustness of platforms can be used for inspection planning. The results of the project are documented in this report.

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EXECUTIVE SUMMARY

INTRODUCTION

Offshore platforms require inspection of the underwater portion of the structure on a regular basis. A "robust" structure has inherent redundancies in terms of alternative load paths around any damaged areas and adequately proportioned alternative member strength that allow it to withstand global damage caused by ship impact, fatigue cracking, extreme storms, dropped objects, and other events. Therefore, robust structures may not need as much inspection as other structures, since they are less vulnerable to damage.

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WORK SCOPE

The EQE work scope consisted of four key parts:

Develop dataset. The EQE pushover analyses are contained in various written reports and digital analyses results. This information was desensitized and condensed to form a dataset of pertinent information in spreadsheet format about each of the platforms. The spreadsheet database is one of the deliverables of the project.

2D frame analyses. Review of the dataset indicated that there was insufficient information on the performance of damaged versus undamaged platforms to make good judgment for inspection planning. Therefore, an additional task was developed that analyzed different types of 2D framing schemes (X, K and diagonal braced) in the damaged and undamaged states. This information was later used in conjunction with the dataset information to develop general inspection guidelines.

Evaluation of dataset. The dataset of pushover analysis was divided into a variety of different logical groups (e.g., 8 vs. 6 vs. 4 leg, X vs. K vs. diagonal bracing, etc.) and evaluated to look for trends and other relevant findings. Some of the trends observed in the 2D analyses were used to determine the evaluation parameters.

Inspection planning. The results of the above work were used to develop some general underwater inspection guidelines for offshore platforms.

RESULTS

The dataset was developed from hardcopy and digital information and put into Excel spreadsheet format for easy data manipulation. This was a considerable effort since much of the data was not in consistent format. Table 1 shows an example hardcopy of the dataset (see page ix).

The 2D frame analyses were conducted on five types of framing schemes as shown in Figure 1. Table 2 shows the resulting Residual Resistance Factor (RRF, computed as the ratio of the damaged capacity to the undamaged capacity). As expected, the X bracing has considerable more robustness than K or diagonal braced platforms. The X braced framing had at most about a 50% reduction in capacity for any damaged member versus about an 80% reduction in capacity for the other bracing schemes. The single diagonal bracing scheme is slightly better that the K bracing schemes in terms of damage tolerance (robustness).

| Damage | | Residual R | esistance Fa | ctor (RRF) | |
|--------|------|------------|--------------|------------|------|
| Case | Х | K1 | K2 | SD1 | SD2 |
| Case 1 | 0.80 | 0.18 | 0.17 | 0.16 | 0.17 |
| Case 2 | 0.83 | 0.18 | 0.17 | 0.35 | 0.37 |
| Case 3 | 0.48 | 0.62 | 0.70 | 0.51 | 0.54 |
| Case 4 | 0.56 | 0.58 | 0.55 | | |
| Case 5 | 0.97 | 0.58 | 0.53 | | |
| Case 6 | | 0.56 | 0.55 | | |

Lateral load at Collapse (undamaged)

Table 2 Performance (RRF) of damaged frames

The dataset evaluation showed that the key factors play a role in platform robustness. This was determined by investigating the general trends in the data and explicit statistical evaluation. Figure 2 shows a general trend of how the ultimate capacity changes with water depth. Figure 3 shows statistically how X braced platforms perform better than K or diagonal braced (curves on the right hand side of the graph have better the performance than curves on the left had side). Several of the key findings are:

- *Platform vintage.* Newer platforms perform better than older platforms. This is an expected result given the advances in design codes and was confirmed by this study.
- *Number of legs.* The higher the number of legs, the better the platform performance in terms of reserve strength ratio (RSR). While RSR is not an explicit measure of robustness (in terms of damage tolerance), a higher RSR does indicate a potentially lower reduction in capacity given the loss or damage to any one platform member.
- *Framing scheme*. The dataset evaluation showed similar results as the 2D analysis in terms of framing, with the X braced framing in 3D platforms analyses performing better than K or single diagonal bracing.
- Other issues. Grouting of the leg-pile annulus (which increases platform capacity, particularly joints) and situations where the design wave impacts the deck (older

platforms with low set decks, which decreases capacity) were shown to be other issues where there was a consistent trend in the data.

RECOMMENDATIONS

This project has provided an opportunity to put together the various pushover analyses performed in the past and to study the effect of different parameters on the ultimate strength of the platforms. In addition, the effect of bracing schemes on strength and robustness was studied quantitatively by conducting pushover analyses on two-dimensional frames with different bracing schemes. The following recommendations are made to extend this information and to develop a further understanding on the robustness of the platforms and the development of inspection strategies:

- Extend the dataset to include additional platforms. The dataset used in this study consisted of a variety of platform types and configurations from around the world; however, most of the data represents shallow water Gulf of Mexico. This effort would involve gathering of new platform ultimate capacity information, with a focus on North Sea type platforms. The data would come from HSE files or perhaps from operators for in-kind exchange of some portion of the results of the project.
- *Extend the results to more complex framing schemes.* This project focused on generally simple framing schemes a necessary step in understanding platform robustness. This work would involve a combination of additional 2-D (and perhaps 3D) ultimate strength analysis and additional data gathering and evaluation related to new platforms added to the dataset. The focus would be to understand some of the more complex framing schemes that are typically found in North Sea platforms.
- Develop a risk-based inspection planning process. The work developed by this project provides an initial basis for prioritized inspections. However, there are numerous factors that must also be accounted for when developing an inspection plan, for example, the consequence of failure of a platform (e.g., manned vs. unmanned), results of previous inspections and any known damage, as mentioned in the ISO and API inspection guidelines. The information developed in the project described in this document, along with other EQE and/or HSE studies (e.g. Flooded Member Detection JIP), provides a good opportunity to develop a risk-based inspection approach that can be used by the HSE to prioritize efforts associated with inspection planning and review.

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|----------------|---|-----------------------|--------------------------------|-----------------------------|--|--|--|--|--|-----------------------------|---|--|--|--|---|--|--|--|--|--|----------------------------------|-----------------------------------|---------------------------------|--|--|---|--|---|
| | Type at First ension,Co | npression) Yield (II) | | | 21 | 22 | 28 | | | | | | | | | | | | | | | | | | | | | |
| | BS at First Member (T | Yield | | | 2615 | 2577 | 3024 | | | | | | | | | | | | | | | | | | | | | |
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| SMENT | ar RSR | | 4.80 | 220 | 1.85 | 1.55 | 2.85 | 2.30 | 4.11 | 320 | 2.63 | 2.04 | 3.69 | 3.15 | 5.62 | 5.10 | 2.85 | 2.05 | 1.45 | 2.50 | 2.18 | 422 | 3.45 | 4.06 | 1.81 | 2.01 | 1.64 | 3.12 |
| ASSES | API 100-Ye Base Shei | | 989 | 1150 | 1743 | 1717 | 1165 | 1039 | 748 | 731 | 1287 | 1339 | 947 | 819 | 672 | 667 | 816 | 1598 | 1999 | 1464 | 1039 | 746 | 731 | 820 | 1481 | 1747 | 1549 | 1039 |
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| z | Orientation wrt True North | UN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | MOEN | W07N | W0/N | W02N | W70W | M07N |
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| | Ver | 1 | F-01 | 4F-02 | √F-03 | 4F-04 | NF-05 | 4F-06 | √F-07 | NF-08 | 4F-01 | NF-02 | √F-03 | €F-04 | NF-05 | NF-01 | NF-02 | √F-03 | NF-04 | NF-05 | NF-06 | NF-07 | NF-08 | NF-01 | NF-02 | NF-03 | NF-04 | 4F-05 |
| 1 | Push-O | | P01-P | 1 | 1-1-0 | 1 | 5 | 1 | 1-1-0 | P01- | P02-I | P02-I | P02-I | P02-1 | P02- | P03- | P03-I | P03-1 | P03-I | P03-I | P03-I | P03-I | P03- | P04 | P4 | P04- | P04-1 | P04-1 |









Figure 3 Cumulative distributive functions for different bracing-schemes eight leg-platforms (all vintages)

1.0 INTRODUCTION

1.1 GENERAL REMARKS

Health and Safety Executive tasked EQE International, Inc. to study the effect of robustness of platforms on inspection planning. The ability of offshore platforms to withstand global damage caused by ship impact, fatigue cracking, extreme storms, dropped objects, and other events without collapsing is a function of robustness. A robust structure has inherent redundancies in terms of alternative load paths around damaged areas and adequately proportioned alternative member strength that allow it to survive these types of incidents.

Robustness is a measure of a platform's ability to sustain damage with a limited loss of ultimate capacity and, therefore, reliability [2]. Damage to a robust structure may result in little immediate risk to the facility. For less robust structures, however, a small damage event may significantly diminish the platform's global capacity resulting in a high-risk situation which requires immediate response such as platform de-manning, platform shutdown, or emergency repair. Since damage to robust structures has less affect on the structure's capacity, such platforms may not require the same frequency of inspection as other structures.

Ultimate strength analysis is critical for understanding and defining robustness. Design of offshore structures has traditionally been based on elastic analysis to determine the distribution of forces throughout the structure, for an envelope of design cases. Checks are then performed on a component-by-component basis to ensure that no element of the structure fails to meet the governing criteria. Most offshore jacket structures possess an inherent reserve strength that is greater than the strength of the critical components. Nonlinear frame analyses of offshore platforms provide a better understanding of the overall structural system.

In ultimate strength analysis, the nonlinearities associated with plasticity and large deformations of the components are included explicitly in the finite element modeling of the jacket. The analysis tracks the plastification process within components as well as the interaction between components through redistribution of the forces resulting from changes in local stiffness. Due to plastic behavior prior to failure, the jacket will exhibit reserve strength beyond the required design resistance.

Ultimate strength analysis determines the reserve strength, redundancy, and global mechanism of jacket failure in order to predict the physical behavior of the platform as accurately as possible.

Having analyses of over 65 specific platforms from around the world, EQE has one of the largest in-house datasets of this type of information available. The dataset is a compilation of EQE's work and work by EQE staff while at other organizations. This information was used by EQE in this study to better understand platform robustness.

1.2 SCOPE OF WORK

The following tasks describe the scope of work performed to study platform robustness and its effect on the inspection of platforms:

Prepare Dataset

Develop a single dataset of ultimate strength analyses for a variety of platform configurations, based upon the EQE platform ultimate strength information. For each platform analysis case, identify the type of software used, types of analyses performed, assumptions made, and other pertinent information that may assist in understanding and differentiating results. The data was desensitized to remove information related to the platform owner.

Ultimate Strength Analyses of 2-D Frames

Perform pushover analyses of two-dimensional frames with different bracing schemes in a water depth of 111ft. The frames would be designed to loading that is representative of hydrodynamic loading for a platform in this water depth and would be "pushed-over" in both intact and damaged conditions to study the robustness of the bracing schemes.

• Identify Trends

Identify the trends from the dataset that can be used to quantify and, where possible, predict platform performance.

Use of Robustness on Inspection Planning

Develop an understanding of how this information can be used to assist in inspection planning.

1.3 ORGANIZATION OF THE REPORT

Section 2 presents the assumptions in the development of the dataset and details of the data entry fields.

Section 3 discusses the factors affecting the platform performance and the rules developed to compare the performance of the platforms.

Section 4 presents the results of pushover analyses of two-dimensional frames to study the robustness of X-, K- (including K1 (K pointed down) and K2 (K pointed up)), and diagonal-bracing schemes.

Section 5 discusses the statistical analysis of the dataset and how this information relates to platform performance.

Section 6 describes how the results from Sections 4 and 5 could be used to develop an initial understanding of inspection planning for platforms.

Section 7 presents conclusions and recommendations.

2.0 DATASET DEVELOPMENT

2.1 GENERAL REMARKS

Ultimate strength analyses are carried out to determine a jacket's reserve strength, degree of redundancy, and modes of failure. The static pushover consists of a representative profile of lateral wave forces acting on the platform, including those affecting the deck, which is applied in a step-wise increasing manner until the platform collapses [6]. The platform's base shear at the time of failure defines its ultimate capacity. The Reserve Strength Ratio (RSR) may be defined as:

RSR Lateral load at ultimate strength of the platform Design lateral load

In this study, the design lateral load is taken as the base shear caused defined by API RP 2A 20th edition [1] environmental recipe.

In other words reserve strength can be defined simply as the ability of a structure to sustain loads in excess of the design load. The fact that a platform has reserve strength does not necessarily indicate over design. Safety factors and conservative design codes build in some reserve strength, which is required to account for wave loading, material and fabrication uncertainties. Additional reserve strength may result from designing for the loads associated with lifting, launch, and installation.

Robustness may be expressed as a function of the relationship between the structure's undamaged and damaged capacities. The capacity of a robust structure would not be greatly affected by common damages. To study the robustness of structures, it is vital to understand the ultimate strength of platforms. As previously noted, EQE has one of the largest in-house datasets of this type of information available that includes the ultimate strength analysis from over 65 platforms. The results have been compiled into a database described further in Section 2.2. The dataset is shown in Table 2.1 (see page 6).

2.2 CONTENTS OF THE DATASET

The ultimate strength of platforms is dependent on several factors. The first step in the development of the dataset was to identify these factors. The following fields are included in the dataset. In the absence of needed data, the associated field was left blank.

2.2.1 Platform information

- *Platform ID*: Unique value used internally to identify the platform.
- **Pushover ID**: Push over identifier to identify the pushover analyses on a particular platform. Note that the pushover ID is of the form P01-NF-001 where P01 is the Platform ID, NF represents a nonlinear foundation, and 001 indicates the first pushover analysis on the platform.
- *Software*: Software used for the analysis. The dataset represents a range of programs including, CAP, SACS, USFOS, SAFJAC, KARMA, ABAQUS, etc.
- *Year Installed*: Year in which the platform was installed at the current site. EQE performed several pushover analyses as a part of the API CBC study where platforms representative of those found in the Gulf of Mexico were analyzed using various bracing

schemes [13, 14]. Where applicable, the year field in these cases shows the API standard to which the platform was designed (i.e. API RP 2A 19th Edition (1989), API RP 2A 20th Edition (1993), etc.).

- *Location*: Location of the platform. The dataset contains platforms located throughout the world including offshore Gulf of Mexico, California, North Sea, Alaska, and West Africa.
- **Orientation**: Orientation of the platforms with respect to true north. Where applicable, in the absence of the orientation data, it was assumed that the end-on direction coincided with the principal direction in the Gulf of Mexico.
- *Water Depth (ft)*: The depth of water in which the platform is located.

2.2.2 Jacket information

- *Number of Legs*: The number of legs of the platform.
- *Number of Bays*: The number of bays of vertical bracing typically equal to one less than the number of horizontal plan levels on the jacket. For example, if a jacket located in a water depth of 100 ft. has horizontal plan levels at elevations, (-) 100', (-) 60', (-) 25', and (+) 10', then, based on this definition, there are 3 bays.
- *Longitudinal Batter*: Batter of the longitudinal frame of the platform.
- *Transverse Batter*: Batter of the transverse frame of the platform.
- *Longitudinal Bracing Scheme*: Bracing scheme of the longitudinal frame of the platform.
- *Transverse Bracing Scheme*: Bracing scheme of the transverse frame of the platform.
- *Overlap of K-joints*: Indicates an overlap of braces at K-joint, wherever applicable. Overlapped K-joints have greater capacities than gapped joints.
- *Joint Can*: This field indicates the presence of joint cans. Platforms with joint cans perform better than those without joint cans.

2.2.3 Pile information

- *Pile Grout*: Indicates whether or not the leg/pile annulus is grouted. In the absence of the data, the leg/pile annulus was assumed to be not grouted.
- *Number of Skirt Piles*: Number of skirt piles present.
- *Number of Leg Piles*: Number of legs containing piles.
- Actual Pile Penetration (ft): Vertical penetration of the piles below the mudline as installed.
- *Pile OD (in)*: Outside diameter of the piles at the mudline.
- *Pile Wall-thickness (in)*: Wall thickness of the piles at the mudline.

• *Number of Conductors*: Number of conductors carried by the platform. This information is most relevant when we know the number of conductors for which the platform was designed and the number of conductors actually present.

2.2.4 Deck information

- *Deck Size (Length of the deck (ft) x width of the deck (ft))*: Sizes of the decks. Input the dimensions of all the decks present.
- *Deck Leg Spacing (ft)*: Spacing of legs at the deck level.
- *Number of Deck Elevations*: Number of decks present on the platform.
- *Lower Deck Elevation (ft)*: Elevation of the lowest deck above mean water level.
- *Air gap (ft)*: Difference between deck height and the calculated crest of the wave. In this study, API 100-year design wave is used to determine the air-gap for the platforms. It was assumed that the wave crest is approximately 60% of the wave height.

2.2.5 Assessment information

- *Wave Height (ft)*: Wave height at which the platform was pushed over.
- *Time Period (sec)*: Wave period corresponding to the above wave.
- *Current (knot)*: Speed of current at which the platform was pushed over.
- *Storm Surge (ft)*: Height of storm surge used in the analyses.
- *Wind Speed (knots)*: Wind velocity used in the pushover analysis.
- *Deck Weight (kips)*: Structural and equipment weights applied to the deck.
- *Wave in Deck*: Indicates whether or not the API 20th Edition 100-year wave inundates the deck. This field depends on the air-gap described in the previous section. An air-gap greater than 0 indicates no wave-in-deck.
- **Direction of Wave**: Direction of wave propagation used in the pushover analysis. Typical pushover directions used in the datasets are demonstrated in the Figure 2-1.
- *API 100-year Base Shear (kips)*: Base shear computed for the API 20th Edition 100-year environmental loading.
- *Reserve Strength Ratio (RSR)*: Ratio of base shear at ultimate capacity of the structure to the 100-year base shear.
- *Ultimate Strength (kips)*: Ultimate capacity of the platform for the environmental loading described above.
- *Failure Mechanism*: Mechanism of platform failure when pushed over.
- Base shear at first member yield (kips): base shear at the first occurrence of yield.
- *Member Type*: Type of member (i.e. tension or compression) in which the first yield occurred.

- **Deflection at First Yield (in)**: Maximum deflection when the first yield occurred.
- **Deflection at Ultimate Capacity (in)**: Maximum deflection at ultimate capacity (i.e. just prior to collapse).
- *Node at which Deflections Measured*: Node at which the deflections were measured.



Figure 2-1 Pushover analysis directions

Table 2.1 Dataset of pushover results

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| | a E E | Mem | 23 | ¢0 | n 271 | g in 27(| 53 | g in 24(| 286 | | 24(| | 1 | ş | | | 58 | strut 274 | 192 | | | 372 | | | | | _ | | | | | | | | | <u> </u> |
| MATION | E all uro Machanie | | Jacket Failure | Foundation Failure | Jacket & Foundation Failure | Plasticity and Hinghi Jacket & Foundation Failure | Jacket | Plasticity and Hinghi Jacket & Foundatic Failure | Jacket Fallure | Foundation Failur | Jacket & Foundatk Failure | | Jacket face Diagon | Jacket K-brace Join | Ple and Jacket Collapse | Jacket Collapse | Shut Buckling | Yielding in Piles and : buckling | Shut Buckling | Ples Plunge | Pies Plunge | Piles Plunge | Pile Pull Out | Pile Pull Out | Vertical Diagonal | Vertical Diagonal | Vertical Diagonal | Jacket | Jacket | Jacket | Pile | Jacket | Jacket | Pile | Pile | Frame Failure/ Displacement > 5 |
| LINFOR | Ultimate Base | Shear (kips) | 2528 | 2679 | 3014 | 2781 | 2956 | 2611 | 2775 | 2725 | 2993 | | 2614 | 1307 | 2556 | 2321 | 2660 | 3500 | 2650 | 3897 | 3287 | 3967 | 13718 | 11566 | 1107 | 1116 | 1120 | 1584 | 1096 | 1250 | 1184 | 1116 | 991 | 1216 | 1324 | 1342 |
| SSMEN | | | 2.50 | 1.75 | 2.10 | 1.95 | 1.75 | 1.75 | 2.50 | 1.75 | 2.05 | | 1.09 | 0.55 | 1.18 | 1.18 | 1.66 | 1.62 | 1.02 | 3.35 | | 2.02 | | | 2.25 | 2.17 | 2.77 | 1.41 | 1.42 | 1.80 | 1.62 | 1.26 | 99:0 | 19:0 | 69'0 | 66:0 |
| ASSE | API 100 | Shear | 1011 | 1531 | 1435 | 1426 | 1689 | 1492 | 1110 | 1557 | 1460 | | 2390 | 2390 | 2160 | 1966 | 1602 | 2303 | a 2598 | 1163 | | a 1963 | đu | _ | 493 | 515 | 405 | 1125 | 71 | 693 | 731 | 885 | 1521 | 1802 | 1916 | 1355 |
| | Direction | of Wave | East | SouthEas | South | SouthEas | South | South West | East | South East | South | | 90 wrt PlatN. | 90 wrt PlatN. | Diagona | Broadsid | EndOn | Diagonal | Broadsid | EndOn | Diagona | Broadsid | Broadsid | Diagona | EndOn | Diagona | Broadsid | 4 (wrt PN- Clockwis | 49 | 94 | 139 | 185 | 229 | 290 | 319 | Orthogor al |
| | Wave in | (Yes/Nc | Ŷ | N N | N | N | Ŷ | Ŷ | N | Ŷ | Ŷ | | Ŷ | Ñ | N | Ŷ | N | Ŷ | Ŷ | N | Ŷ | No | N | Ŷ | | | | N. | Ŷ | Ŷ | Ŷ | Ŷ | Ŷ | N | 8 | ž |
| | d Deck | ot) (kips) | 3860 | 3860 | 3860 | 3860 | 3860 | 3860 | 3860 | 3860 | 3860 | | _ | | 1241 | 1241 | _ | | | 8 | | 6 | | | 3360 | 3360 | 3360 | | | | | | | | | _ |
| | torm Win | (t) (knc | 4.2 80 | 4.2 80 | 4.2 80 | 128 80 | 128 80 | 128 80 | 4.2 80 | 4.2 80 | 4.2 80 | | 3.5 70 | 3.5 70 | 86 | 86 | 3 70 | 3 70 | 3 70 | 5.74 10 | 5.92 10 | 5.74 10 | | | | | | 3.21 70 | 321 70 | 3.21 70 | 321 70 | 321 70 | 321 70 | 321 70 | 321 70 | - |
| | Current | (knot) | 1.68 | 2.08 | 2.08 | 1.612 | 2.092 | 1.345 | 1.68 | 2.08 | 1.25 | | 1.8 | 1.8 | 2.3 | 2.3 | 1.8 | 1.8 | 1.8 | 3 | 2.8 | 3 | | | | | | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | - |
| | Time | (sec) | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | | 12.5 | 12.5 | 13.5 | 13.5 | 12.5 | 12.5 | 12.5 | | | | | | | | | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | |
| L | k Wave | e E | 5 43.9 | 52.7 | 58.5 | 5 52.74 | 5 58.6 | 5 55.67 | 5 43.9 | 5 52.7 | 58.5 | | 49.88 | 49.88 | 67.5 | 64.125 | 54.6 | 57.5 | 51.8 | 6 85 | 80 | 6 85 | 2 | 10 | | | | 5 48.5 | 5 43.4 | 5 35.8 | 5 35.8 | 5 35.8 | 5 38.3 | 5 46 | 5 51.1 | |
| | dr Low | 88 € | 5.4 61. | 8.4 61 | 6.4 61. | 6.4 61. | 8.4 61. | 61. | 5.4 61. | 5.4 61. | 61) | | 7.2 52 | 7.2 52 | 15 47 | 15 47 | 6 46 | .6 46 | .6 46 | .86 61.4 | .96 61.4 | .86 61.4 | 2.1 53. | 2.1 53. | 32 | 32 | 32 | 1.15 54.7 (TO | 1.15 54.7 (TO | 1.15 54.7 (TO | 1.15 54.7 (TO | 1.15 54.7 (TO | 1.15 54.7 (TO | 1.15 54.7 (TOL | 1.15 54.7 (TO | 78 50.5 |
| ATION | ther of A | ations | 2 | 2 | 2 2 | 2 21 | 2 | 2 | 2 2 | 2 | 2 | | 2 | 2 | 2 | 2 | 2 7 | 2 7 | 2 | 2 21 | 2 21 | 2 21 | ÷ | 4 | | | | 2 22 | 2 | 2 | 2 2 | 2 | 2 2 | 2 2 | 2 | 6 |
| INFORM | * Leg Num | acing Elev | (Long) (Tran) | (Long) (Tran) | (Long) (Tran) | (Long) (Tran) | (Long) (Tran) | (Tran) | (Long) (Tran) | (Long) (Tran) | (Long) (Tran) | | | | | | | | | | | | | | | | | | | | | | | | | - |
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| | N N | e E | | | | | | | | | | | | | | | 12 | 2 | 7.5 | 2.25 | 2.25 | 2.25 | | | | | | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 0.625 |
| ATION | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | e e | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | | 8 | 8 | 8 | 8 | 7 | 4 | 4 | 48 | 8 | 48 | | | | | | 90 | 8 | 8 | 90 | 90 | 8 | 8 | 90 | 8 |
| INFORM | Actual Pile | (H) | 185-210 | 185-210 | 185-210 | 210-230 | 210-230 | 210-230 | 210-230 | 210-230 | 210-230 | | 230 | 230 | 190-227 | 190-227 | 255 | 255 | 255 | 295 | 295 | 295 | | | 109 | 109 | 109 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | |
| PILES | Number | Piles | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Number | Skirt Piles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L | Piles | (Yes/No) | Ŷ | Ŷ | No | No | Ŷ | Ŷ | oN | Ŷ | Ŷ | Yes | Yes | Yes | N | Ŷ | N | Ŷ | Ŷ | Yes | Yes | Yes | N | NN N | No | Ŷ | Ŷ | 0N | Ŷ | Ŷ | Ŷ | Ŷ | Ŷ | N | Ŷ | Yes |
| | Joint | (YesNo) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes | Ŷ | Ŷ | Ŷ | Yes | Yes | Yes | | | | | | Yes (Legs) | Yes (Legs) | Yes (Legs) | Yes (Legs) | Yes (Legs) | Yes (Legs) | Yes (Legs) | Yes (Legs) | Yes (Leos) |
| 1 | Over Lap | (Yes/No/NA | N | NA | NA | NA | NA | NA | NA | NA | NA | N | | | νv | NA | | | | NA | NA | NA | | | | | | | | | | | | | | Ŋ |
| ATION | Trans. | (SD, X,K1,K2) | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | × | K1,K2 | K1,K2 | × | × | K1,K2 | K1,K2 | K1,K2 | SD | SD | SD | × | × | SD | SD | SD | X,K2 | X,K2 | X,K2 | X,K2 | X,K2 | XK | X,K2 | хка | ž |
| INFORM | Long. | 3D,X,K1,K2) | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | SD1,SD2 | × | K1,K2 | K1,K2 | × | × | K1,K2 | K1,K2 | K1,K2 | ß | ß | SD | × | × | SD | SD | SD | ХК2 | X,K2 | хĸ | X,K2 | X,K2 | X,K2 | ХKZ | хĸ | ž |
| ACKET | Trans. | Batter | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 0 | 1 in 7.5 | 1 in 7.5 | 1 in 7 | 1 in 7 | | | | 1 in 10 | 1 in 10 | 1 in 10 | | | 0 | 0 | 0 | 1in 8 | 1in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1in 8 | 1 8 8 | 1 in 8 | 1 in 8 |
| ^ | - rong. | Batter | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 0 | 1 in 7.5 | 1 in 7.5 | 1 in 7 | 1 in 7 | | | | 1 in 10 | 1 in 10 | 1 in 10 | | | 0 | 0 | 0 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 | 1 in 8 |
| | Number | Bays | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | 3 | 3 | 2 | 2 | 9 | 9 | 9 | 4 | 4 | 4 | 2 | 5 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | е | 3 | 4 |
| L | Number | of Legs | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | 1 Water | n Depth | Ē | 11 | 11 | 1 | ŧ | £ | 11 | E | 11 | ê | 103 | 103 | 160 | 9 | 182 | 182 | 182 | 219 | 219 | 219 | 468 | 468 | 161 | 161 | 161 | 96 | 36 | 96 | 96 | 96 | 96 | 96 | 96 | 61 |
| R. | Orientation | True North (TN) | N02N 0. | o N70W | 0 N70W | 0 N70W | 0 N70W | 0 N70W | 0 N70W | 0 N70W | 0 N70W | NSOW | • | 0 | WDEN 0 | 0 N30W | o N10E | o N10E | o N10E | o N25W | o N25W | o N25W | o N15E | o N15E | | | | 0 N41W | 0 N41W | o N41W | 0 N41W | 0 N41W | 0 N41W | o N41W | o N41W | o N12W |
| ORMATIC | - Creation | 1002001 | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic. | Gulf of Mexic. | Guff of Mexic | Gulf of Mexic | Gulf of Mexic | Alaska | Gulf of Mexic | Gulf of Mexic. | Gulf of Mexic. | Gulf of Mexic. | Gulf of Mexic. | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic | Guff of Mexic | Gulf of Mexic | Gulf of Mexic | West Mrica | West Mrica | West Africa | Guff of Mexic | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic | Gulf of Mexic | Guff of Mexic | Gulf of Mexic. | Gulf of Mexic. | Guff of Mexici |
| NRM INF | Year | Installed | 1993 | 1993 | 1993 | 1989 | 1989 | 1989 | 1989 | 1989 | 1989 | 1968 | 1969 ⁴ | 1969 ^A | 1970 | 1970 | 1971 | 1971 | 1971 | 1984 | 1984 | 1984 | 1991 | 1991 | 1981 | 1981 | 1981 | 1978 ⁰ | 1978 | 1978 | 1978 | 1978 | 1978 | 1978 | 1978 | 1969 |
| LATFO | Software | | SACS | SACS | SACS | SACS | SACS | SACS | SACS | SACS | SACS | CAP | USFOS | USFOS | | | | | | SACS | SACS | SACS | | | CAP | CAP | CAP | | | | | | | | | CAP |
| ľ | n Push-Over | • | POSC-NF-01 | P05C-NF-02 | POSC-NF-03 | PO5D-NF-01 | P05D-NF-02 | PO5D-NF-03 | P05E-NF-01 | P06E-NF-02 | POSE-NF-03 | P06-NF-01 | P07-NF-01 | P07-NF-02 | P08-NF-01 | P08-NF-02 | P09-NF-01 | P09-NF-02 | P09-NF-03 | P13-NF-01 | P13-NF-02 | P13-NF-03 | P16-NF-01 | P16-NF-02 | P17-NF-01 | P17-NF-02 | P17-NF-03 | P22-NF-01 | P22-NF-02 | P22-NF-03 | P22-NF-04 | P22-NF-05 | P22-NF-06 | P22-NF-07 | P22-NF-07 | P25-NF-01 |
| | Platform | • | P05-C | P05-C | P05-C | P05-D | P05-D | P05-D | PO5-E | P05-E | P05-E | P 06 | P07 | P07 | P.08 | P.08 | 60 d | P09 | P 09 | P13 | P13 | P13 | P16 | P16 | P17 | P17 | P17 | P22 | P22 | P.22 | P22 | P22 | P22 | P22 | P22 | P.25 |

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| | Γ | io de defl. feasured | Γ | | | | | | | | | | | | | | | | | | | | | | | | | | Deck Node | 1032 Deck Node | Deck Node 1032 | Deck Node 1032 | | | | | |
|---|--|---|--|--|--|--|---|------------------------------|------------------------------|--------------------------|--------------|--------------|----------------------------|--------------------------|--------------------------|-------------------------------|-------------------------------|--------------------------------|----------------------------|---------------------------|---------------------------|---------------------------|--------|---|--|----------------------------------|---------------------------|-------------------------|----------------|----------------------|----------------------|--------------------------------|--|-----------------|----------------|---------------|------|
| | | Defl. at N Ultimate N | (III) DPO- | | | | | | | | | | 16.5 | Ξ | 4 | 6.25 | 13 | 6.25 | | | | | | 13.7 | 14.5 | 6 | | | | | | | 36 | 62 | 75 | 15 | |
| Image: sector control contro con | | Defi. at First fold (in) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ype sion, Co | (Lional and Lional and Liona | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | pression | pression | pression | | |
| Image: second contractioned contrac | | Sat Me rst T mber (Ten me | ndu na | _ | _ | | _ | | | | | | | | | | | | | 976 | 014 | 675 | | | | | | _ | 356 | 392 | 789 | | 298 Com | 302 Com | 108 Com | 780 | |
| | | Mechanism He | lation Axial Exceeded. Pile | asticity lation Axial Exceeded. Pile | asticity lation Axial Exceeded. Pile | asticity lation Axial Exceeded. Pile | asticity lation Axial y Exceeded. | Flatform Piles | Platform Piles | Flatform Piles | e Hinge | e Hinge | s Plunge | s Plunge | s Plunge | s Plunge | s Plunge | s Plunge | le Failure/ cement > 5' | ssion Member 10 Buckle | ssion Member 12 Suckle | ssion Member 10 Sucide | | s Plunge | s Plunge | s Plunge | | _ | actient 3 | acket 5 | acket 30 | orm response n linear mode. | Buckling of K- nd yielding in 62 legs. | t Diagonals 40 | I Diagonals 6- | acket 5 | |
| | FORMATIO | mate ase Failure heat | Found Found 560 Capacity | Pauro Found B20 Capacity | Pl Found 070 Capacity | 510 Capacity | 740 Found | 080 Hinging of | 060 Hinging of | 080 Hinging of | 923 Pil | 915 Pil | 966 Pile | 59 Pile | 82 Pile | 101 Pile | 193 Pile | 083 Pile | 984 Fram Displa | 1152 Compret | 458 Compres | 625 Compres | | 760 Pile | 290 Pile | 581 Pile | 237 | 964 | 425 | 199 | 338 | B86 The platt was still i | Jacket. 8 298 braces a | 560 Jacke | 587 Jacke | r 6201 | |
| | AENT IN | RSR B | 2.10 | 1.38 | 1.51 | 1.45 | 128 | 0.83 | - | 1.88 | 1.64 | 2.11 | 1.23 | 0.71 | 0.76 | 1.40 | 0.86 | 0.70 | 1.45 | 2.04 2 | 1.70 | 2.31 16 | | 1.69 2 | 0.81 2 | 1.03 2 | 2.72 3 | 2.80 3 | 1.18 | 128 | 1.31 4 | 1.39 | 1.20 | 1.12 | 1.26 6 | 3.18 | |
| | SSESSI | PI 100- bar Base Shear | 2170 | 2770 | 3350 | 3180 | 3120 | 1298 | | 573 | 1176 | 906 | 784 | 12 12 | 1299 | 787 | 1384 | 1548 | 1365 | 9888 | 6744 | 7194 | | 1629 | 2842 | 2509 | 1190 | 1412 | 3736 | 47.46 | 3314 | 4223 | 5256 | 4154 | 5232 | 4726 | |
| Image: constrained and provided an | A | Wave Yo | Mest | Mest | Vorth | th West | West | uObn | agonal | adside | uObn | agonal | uOpu | agonal | adside | uObn | agonal | adside | hogonal | s | w | s | | uOpu | agonal | adside | uObn | agonal | 96 wt | 40 wrt Caxis | B0 wtt (-axis | 70 wrt (-axis | adside | uOpu | agonal | uOpu | |
| | | fave in Dia Deck of | | - | - | N | | Yes E | Yes DI | Yes Bro | u | ō | No | No | No | Yes E | Yes DI | Yes Bro | 04 | Ŷ | Ŷ | N | | No No | N N | No Bro | U I | ŏ | N P | No No | ° ≈ | No 2 | No Bro | N N | No Di | N | |
| Transmertantial contrast contra | | Deck Weight (kips) | | | | | | | | | | | | | | | | | | 28399.8 | 2552 | 2552 | | | | | | | 8224 | 8224 | 8224 | 8224 | | | | | |
| | | n Wind e Speed (knot) | 143 /fhei | 143 (filme) | (ijus) 143 /ihne) | (me) | (fps) | | | | | | 7 74 | 65 | 65 | 12 | 74 | 7 | | 106.64 | 39 79.643 | 39 79.643 | | 2 80 | 74 | 74 | | | 20 | 70 | 70 | 70 | 85 | 85 | 85 | 70 | |
| | | rent Storr Surg (ft) | 3 | 9 9 | 3 10 10 10 | 3 | 3 (58) (58) | | | | | | 87 2.91 | 55 22 | 55 22 | 75 2.7 | 87 2.97 | 75 2.7 | | 195 | 2455 7.020 | 2455 7.020 | | 08 3.52 | 87 2.91 | 87 2.9 | | _ | | 89 | 8 | 80 | 8 | 8 | 28 | 80 3.5 | |
| | | Time Cur Period (ke | 13.5 | 13.5 | 13.5 | 13.5 | 13.5 | | | | | | 12.6 1 | 11.9 | 11.9 | 12.4 1 | 12.6 1 | 12.4 1 | | 14.4 2.7 | 13.9 3.2 | 13.9 3.2 | | 13 2 | 12.6 1 | 12.6 1 | | | 12.5 | 12.5 | 12.5 | 12.5 1 | 14.3 2 | 14.18 2 | 14.31 2 | 12.5 1 | |
| | L | Wave Height (ft) | 68 | 68 | 57.6 | 64.6 | 68 | 623 | 62.3 | 623 | | | 57.5 | 50 | 20 | 55 | 57.5 | 22 | | 92.847 | 61.679 | 61.679 | | 62.5 | 57.5 | 57.5 | | | 69 | 53.1 | 58.02 | 47.2 | 72 | 68.4 | 72 | 6'19 | |
| Important APPRIMANT APPLIA APPLIA APPLIA APPLIA APPLIA APPLIA <th co<="" td=""><th></th><td>P Deck</td><td>Ē</td><td></td><td>_</td><td></td><td></td><td>15 38.25</td><td>15 38.25</td><td>15 38.25</td><td></td><td></td><td>39</td><td>38</td><td>39</td><td>7 36.5</td><td>7 36.5</td><td>7 36.5</td><td></td><td>74.474</td><td>70.537</td><td>70.537</td><td></td><td>3 37.33</td><td>3 37.33</td><td>3 37.33</td><td></td><td>_</td><td>6 45.5 TTOP</td><td>6 45.5 (TOS)</td><td>6 45.5 (TOS)</td><td>6 45.5 (TOS)</td><td>3 47</td><td>3 47</td><td>3 47</td><td>46.5</td></th> | <th></th> <td>P Deck</td> <td>Ē</td> <td></td> <td>_</td> <td></td> <td></td> <td>15 38.25</td> <td>15 38.25</td> <td>15 38.25</td> <td></td> <td></td> <td>39</td> <td>38</td> <td>39</td> <td>7 36.5</td> <td>7 36.5</td> <td>7 36.5</td> <td></td> <td>74.474</td> <td>70.537</td> <td>70.537</td> <td></td> <td>3 37.33</td> <td>3 37.33</td> <td>3 37.33</td> <td></td> <td>_</td> <td>6 45.5 TTOP</td> <td>6 45.5 (TOS)</td> <td>6 45.5 (TOS)</td> <td>6 45.5 (TOS)</td> <td>3 47</td> <td>3 47</td> <td>3 47</td> <td>46.5</td> | | P Deck | Ē | | _ | | | 15 38.25 | 15 38.25 | 15 38.25 | | | 39 | 38 | 39 | 7 36.5 | 7 36.5 | 7 36.5 | | 74.474 | 70.537 | 70.537 | | 3 37.33 | 3 37.33 | 3 37.33 | | _ | 6 45.5 TTOP | 6 45.5 (TOS) | 6 45.5 (TOS) | 6 45.5 (TOS) | 3 47 | 3 47 | 3 47 | 46.5 |
| The contract co | ATION | tions (ft | ~ | 8 | | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | 8 | -0. | -0. | -0. | | | 5 | 5 | 5 | 9 | 9 0 | φ N | | | ~ | ~ | | 3 0.7 | 3 0.7 | 3 0.7 | 8 | ~ | \$ | \$ 2 | 5 | \$2 N | 2 63 | 61 | 2 63 | 22 | |
| Image: constrained by the state of | ECK INFORM | Deck Leg Numl Spacing Eleva | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Terrectant contractione c | | r Deck Size | | | | | | 24'x56' (CD) 56'x56' (MD) | 24'x56' (CD) 56'x56' (MD) | 24%56'(CD) 56%56'(MD) | | | 52'x43'(CD) 72'x52 (MD) | 52x43'(CD) 72x52 (MD) | 52x43'(CD) 72x52 (MD) | 47.5x61.75' (CE 47x52 (MD) | 47.5x61.75' (CE 47x52 (MD) | 47.5x61.75' (CC 47x52' (MD) | | 164.04x98.42ft | 72.18x59.05ft | 72.18x59.05ft | .EG | 20'x31.67' (SD) 45'x97.5' (CD) 45'x97.5' (MD) | 45'x97.5' (SU) 45'x97.5' (CD) 45'x97.5' (MD) | 45'x97.5' (CD) 45'x97.5' (MD) | | | .EG 136x/72 | 136×72 | 136×7Z | 136×72 | 166×76 | 166×76 | 166×76 | | |
| The contract | | Number of Conducto | a 12 | 22 | 28 | 28 | 28 | 0 | 0 | 0 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | | 22 | ~ | 7 | 9-1 | 80 | 8 | 80 | | | 21 | 21 | 21 | 21 | 18 | 18 | 18 | 24 | |
| Terrection contractione c | z | Pile VT (ii) | | 0.00 | | - A | <u>_</u> | 0.75 (ML) | 0.75 (ML) | 0.75 (ML) | | | 0.75 | 0.75 | 0.75 | 1.5 (ML) | 1.5 (ML) | 1.5 (ML) | | 9 | 3 2.561 | 3 2.561 | | 1.25 (ML) | 1.25 (ML) | 1.25 (ML) | | | 2.5 | 2.5 (ML) | 2.5 (ML) | 2.5 (ML) | 2.0 (ML) |) 2.0) (ML) | 2.0 (ML) | | |
| Interpretational anticol an | RMATIC | Pile Pile (in) | 48 (2 | 48 (2 | 48 (2 | 48 (2 | 48 (2 | 8 | 8 | 8 | | | 30 | 8 | 8 | 30 | 8 | 8 | | 52 98:13 | 68 72.06 | 68 72.06 | | 8 | 8 | 8 | 8 | 8 | 12 42 | 12 42 | 12 42 | 12 42 | 48 | 48(P 42(S | 48 | 40 48 | |
| Terret matrial and a proper and a prop | S INFO | Br Actual B Penetra | 340 | 340 | 340 | 340 | 340 | 240 | 240 | 540 | | | 155 | 155 | 155 | 190 | 190 | 190 | | 213.2 | 150.91 | 150.91 | | 165 | 165 | 165 | 105 | 105 | 360-3 | 360-3 | 360-3 | 360-3 | 300 | 300 | 300 | 320-3 | |
| The contract of the cont | | ber Numb | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 16 | 4 | 4 | | 9 | 9 | 9 | 9 | 9 | 8 | 80 | 8 | 80 | 8 | 80 | 8 | 8 | |
| Trippolity and the partial of the partia of the partia of the partial of the partial of the partial of th | | uted Ski | 8 1 2 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | | 8 | 8 | 8 | 0 2 ⁵ 8 (8) | 0 2 ¹ 2 2 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | |
| Time and the part of the | ŀ | oint Pi Can Gro | Yes | Yes | Yes | Yes | Yes | Yes Y | Yes Y | Yes | Yes N | Yes | Yes N | Yes | Yes | Yes Y | Yes | Yes | > N | Yes | Yes Y | Yes Y | | Yes | Yes | Yes Y | Yes (C1 P | 4 C - 2 | - | ~ | 2 | ~ | Yes Y | Yes | Yes Y | ~ | |
| International internationalinternatinterinternational international international internation | | werLap Joints) s/No/NA) (Y | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | NA | VA | Ŷ | Ŷ | Ŷ | Yes | Yes | Yes | | VN | ę | e | | Yes | Yes | Yes | NA | NA | | | | | Yes | Yes | Yes | | |
| Image: constrained by the constraned by the constrained by the constrained by the con | NOIT | Trans. (Bracing () D,X,K1,K2) (Y | K1,K2 | K1,K2 | K1,K2 | K1,K2 | K1,K2 | K1X | K1X | K1X | SD | SD | K1X | K1X | K1X | Q | g | g | ž | × | k1 | k1 | | 22 | Q. | Q | × | × | K1,K2 | K1,K2 | K1,K2 | K1,K2 | ¥ | 2 | ĸ | K1,K2 | |
| Image: series of the | NFORMA | Long. Bracing 9,X,K1,K2) (S. | K1,K2 | K1,K2 | K1,K2 | K1,K2 | K1,K2 | K1X | K1X | K1X | S | 8 | K1 X | K1 X | K1 X | SD,K2 | SD,K2 | SD,K2 | ž | × | 2 | ĸ | | ß | 8 | SD | × | × | ß | SD | SD | SD | ß | ß | SD | SD,X | |
| International problema interactional problema | ACKET | Trans. Batter (S | 0 | 0 | 0 | 0 | 0 | 1 in 8.5 | 1 in 8.5 | 1 in 8.5 | | | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 9 | 1 in 9 | 1 in 9 | 1 in 8 | 1 in 17.5 | 1 in 11 | 1 in 11 | | 1 in 10 | 1 in 10 | 1 in 10 | | \neg | | | | | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 7.86 | |
| Image: control in the contro | 1 | Long. Batter | 1 in 7 | 1in 7 | 1 in 7 | 1 in 7 | 1in 7 | 1 in 8.5 | 1 in 8.5 | 1 in 8.5 | | | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 9 | 1 in 9 | 1 in 9 | 1 in 8 | 1 in 17.5 | 1 in 1 | 1 in 11 | | 1 in 10 | 1 in 10 | 1 in 10 | 0 | • | | | | | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 7.86 | |
| International and provided in the provisional and provisional and provided in the provisional and provi | | r Number of Bays | ŝ | 9 | 40 | ŝ | 9 | 9 | 9 | 9 | 3 | | 4 | 4 | 4 | 9 | 40 | 40 | 9 | 2 | 2 | 2 | | 4 | 4 | 4 | 8 | | 9 | 9 | 9 | 9 | 2 | ŝ | 2 | 9 | |
| Image: market of the sector of the | L | r Numbe h of Legs | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 4 | 4 | 4 | | 9 | 9 | 9 | 9 | 9 | 80 | 80 | 8 | 8 | 8 | 8 | 8 | 80 | |
| International and factors in the sector in the se | | on Wate th Dept | 180 | 180 | 180 | 180 | 180 | 170 | 8 | ¢1 | 137 | 137 | 4 | 144 | 141 | 140 | 140 | 140 | 61 | 475.7. | 164.0 | 164.0 | | 130 | 130 | 130 | 118 | 118 | 255 | 255 | 265 | 255 | 263 | 263 | 263 | 300 | |
| Imatical participant Imatical | N | Orientation wrt True Nort | NI 05 | 20 Z | 02 | NL 05 | TN | 0,0 | 0.0 | 0,0 | CO NBOW | CO NBOW | 50 N15W | CO N15W | CO N15W | CO N45W | CO N45W | 20 N45W | to N12E | MBN | N24E | N24E | | co N37W | CO N37W | CO N37W | co N45E | co N45E | 30 N10W | co N10W | so N10W | 50 N10W | so N20W | to N20W | so N20W | MOEN 03 | |
| Internation Internation <thinternation< th=""> <thinternation< th=""></thinternation<></thinternation<> | IFORMATI | d Location | Guff of Mexk | Guff of Mexic | Guff of Mexic | Gulf of Mexk | Gulf of Mexic | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Guff of Mexk | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Gulf of Mexk | Norh Sea | Norh Sea | Norh Sea | | Gulf of Mexic | Gulf of Mexi. | Gulf of Mexi. | Guff of Mexic | Guff of Mexi. | Guff of Mexic | Guff of Mexic | Gulf of Mexk | Gulf of Mexk | Guff of Mexk | Guff of Mexk | Gulf of Mexk | Gulf of Mexic | |
| India India <th< td=""><th>ORM IN</th><td>e rear</td><td>1969</td><td>1969</td><td>1969</td><td>1969</td><td>1969</td><td>1964</td><td>1964</td><td>1964</td><td>1981</td><td>1981</td><td>1963</td><td>1963</td><td>1963</td><td>1964</td><td>1964</td><td>1964</td><td>1969</td><td>S 1998</td><td>S 1988</td><td>S 1988</td><td></td><td>1966</td><td>1966</td><td>1966</td><td>C 1968</td><td>C 1968</td><td>1972</td><td>1972</td><td>1972</td><td>1972</td><td>1973</td><td>1973</td><td>1973</td><td>1973</td></th<> | ORM IN | e rear | 1969 | 1969 | 1969 | 1969 | 1969 | 1964 | 1964 | 1964 | 1981 | 1981 | 1963 | 1963 | 1963 | 1964 | 1964 | 1964 | 1969 | S 1998 | S 1988 | S 1988 | | 1966 | 1966 | 1966 | C 1968 | C 1968 | 1972 | 1972 | 1972 | 1972 | 1973 | 1973 | 1973 | 1973 | |
| Putule Putule Putule | PLATE | softwar | 11 SACS | 11 SACS | 31 SACS | 12 SACS | 33 SACS | 1 SACS | 2 SACS | 3 SACS | 1 CAP | 2 CAP | 1 SACS | 2 SACS | 3 SACS | 1 SACS | 2 SACS | 3 SACS | 1 CAP | 1 ABAQU | 1 ABAQU | 2 ABAQU | | n sacs | g sacs | B SACS | 11 SAFJA | 2 SAFJA | - | 8 | 3 | 7 | 1 CAP | 2 CAP | 3 CAP | 1 SACS | |
| Pathematical Pathematical </td <th></th> <td>Push-Ow ID</td> <td>P26A-NF-C</td> <td>P26B-NF-C</td> <td>P26C-NF-(</td> <td>P26C-NF-(</td> <td>P26C-NF-(</td> <td>P31-NF-0</td> <td>P31-NF-0</td> <td>P31-NF-0</td> <td>P36-NF-0</td> <td>P36-NF-0</td> <td>P42-NF-0</td> <td>P42-NF-0</td> <td>P42-NF-0</td> <td>P49-NF-0</td> <td>P49-NF-0</td> <td>P49-NF-0</td> <td>P50-NF-0</td> <td>P56-NF-0</td> <td>P57-NF-0</td> <td>P57-NF-0</td> <td></td> <td>P35-NF-0</td> <td>P36-NF-C</td> <td>P35-NF-C</td> <td>P51-NF-0</td> <td>P51-NF-0</td> <td>P10-NF-0</td> <td>P10-NF-0</td> <td>P10-NF-0</td> <td>P10-NF-0</td> <td>P11-NF-0</td> <td>P11-NF-0</td> <td>P11-NF-0</td> <td>P12-NF-0</td> | | Push-Ow ID | P26A-NF-C | P26B-NF-C | P26C-NF-(| P26C-NF-(| P26C-NF-(| P31-NF-0 | P31-NF-0 | P31-NF-0 | P36-NF-0 | P36-NF-0 | P42-NF-0 | P42-NF-0 | P42-NF-0 | P49-NF-0 | P49-NF-0 | P49-NF-0 | P50-NF-0 | P56-NF-0 | P57-NF-0 | P57-NF-0 | | P35-NF-0 | P36-NF-C | P35-NF-C | P51-NF-0 | P51-NF-0 | P10-NF-0 | P10-NF-0 | P10-NF-0 | P10-NF-0 | P11-NF-0 | P11-NF-0 | P11-NF-0 | P12-NF-0 | |
| | | Platform | P26A | P26B | P26C | P26C | P26C | P34 | P34 | P34 | P.36 | P.36 | P42 | P.42 | P.42 | P.49 | P49 | P.49 | P-50 | P56 | P57 | 19d | | P35 | P36 | P35 | P61 | P51 | P10 | P10 | P10 | P10 | P11 | P11 | P11 | P12 | |

| Dataset of pushover results |
|-----------------------------|
| Table 2.1 |

| | fef | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--|---|---|--|---|--|--|--|--|---|--|--|---|--|--|--|---|---|--|---|--|--|---|--|--|---|--|---|---|---|--|---|---|--|
| 1 | Node d Measur | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Defl. at Iltimate oad (in) | 14.5 | | | | | | | | | | | | | 30 | 28.8 | 36 | | | | 12 | 11.5 | 17 | 17.5 | 17 | 15 | 13 | 7.5 | 13 | 21.5 | 23.5 | 21 | 23 | 4 | 4 |
| 1 | eft. First d (in) L | | | | | | | | | | | | | | | | | | | | 6.5 | | 12 | 4.5 | 2.5 | 13 | E | ~ | 1.5 | 18 | 17 | 18 | ÷ | 2.5 | 15 |
| | 2 Set | | | | | | | | | | | | | | | | | | | | ι0 | | - | 4 | 4 | - | - | | 4 | - | - | - | - | τ <u>α</u> | = |
| | Member Type ension,C pression | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | a perat Perat | 2 | | | 2 | = | g | 5 | | | | | | | 9 | 9 | - | | | | 4 | 5 | 4 | 2 | 4 | 6 | 8 | Ξ | 3 | 2 | 2 | 9 | <u>®</u> | 8 | 5 |
| | ESS Firs Memi | \$30 | | | 354 | 364 | 433 | 486 | 1.0 | £ 0 8 | | | | | 588 | 528 | 817 | | | | 122 | 182 | 245 | 291 | 296 | 345 | 480 | 408 | 496 | 183 | 50 | 5250 | 256 | 328 | 294 |
| | mism | | e e | an | | | | | and in K 1 and 2 | Piles with n causing | r bay X- s A &B Z highly | | | | | | | 'n | 'n | μ | ae | ae | ae | e | e | at | ae | ae | ae | orm Piles | rm Piles | orm Piles | ae | ae | ae |
| z | e Mechi | Jacket | me Failt | me Fail | Jacket | Jacket | Jacket | Jacket | in Piles in Rows | Iding in I stribution | in lowe in Row | Jacket | Pile | Pile | Jacket | Jacket | Jacket | es Pull (| es Pull O | es Pull (| les Plun | les Plun | les Plun | les Hinç | les Hing | les Hing | les Plun | les Plun | les Plun | of Platfo | of Platfo | of Platfo | les Plun | les Plun | les Plun |
| ATIC | Failur | | Fra | Fra | | | | | rielding | nitial yie oad redi vielding 8 | Yielding braces and Pile | | | | | | | ы | æ | Ы | Ы | H | Pi | ٩ | ٩. | P | Ы | đ | Ы | Hinging | Hinging | Hinging | Ы | đ | đ |
| FOR | imate ase hear los) | 3894 | 00/0 | 1900 | 592 | 719 | 470 | 876 | 237 | 225 | 007 | 238 | 100 | 140 | 1320 | 0120 | 2710 | 420 | 280 | 459 | 142 | 142 | 789 | 243 | 476 | 760 | 178 | 171 | 377 | 973 | 389 | 778 | 387 | 384 | 687 |
| NTN | a s a | 2 2 | × | 17 | 3 | 3 | 4 | 80 4 | 10 | 6 | 8 | 2 | 8 | 6 g | 8 | 8 | 8 | 5 | 6 1- | * | 5 2 | 8 | 2 2 | 34 3 | 35 | 3 | 31 5 | 4 | 8 5 | | 1 2 | 2 | 3 | 8 | 8 |
| SSME | - es . | 3 | | | 4 | ÷ | ÷ | - | 6 | ιń | 4 | 2 | ÷ | 61 | 5 | 2 | 6 | 0 | õ | 0 | 0 | 0 | 0 | 60 | 6 | 1 | 5 | | 2. | 10 | .0 | 6 | 5 | 6 | 9 |
| ASSE | API10 Year Ba Sheai | 4288 | | | 3143 | 33.46 | 4044 | 3254 | 1843 | 1785 | 1669 | 5567 | 47.38 | 3307 | 4528 | 4400 | 4539 | 1889 | 3639 | 2612 | 2257 | 38.39 | 3388 | 35.46 | 4081 | 3611 | 3941 | | 2169 | 23.46 | 3100 | 3260 | 2565 | 3843 | 3959 |
| | action Wave | adside | adside | igonal | 169 .ATFO &M) | 180 | 214 | 270 | adside | igonal | nobr | uOpu | Igonal | adside | uObr | gonal | adside | uObr | gonal | adside | uObr | Bonal | adside | uObr | gonal | adside | uObr | Bonal | adside | uObr | gonal | adside | uObn | Igonal | adside |
| | e in Dir :k of) No) of) | Bro | Bra |) Dia | , PL | | | | Bro | Dia | Er | > Er | Dia | Bra | Ē | Die | Bro | > Er | Dis | Bra | s Er | s Die | s Bro | s Er | s Dis | s Bro | , Er | Dia | Bra | e E | s Did | s Bro | s Er | s Dia | s Bro |
| | t Dec (Yes/ | ž | ž | Ň | Ň | ž | ž | Ň | | | | Ň | ž | ž | ÿ | ž | ž | ž | ž | Ň | Ye | Υe | Ye | Ye | Υe | Ye | Ň | ž | Ň | Ye | Ye | , e | Ye | Ye | , e |
| | Dech Weigh (kips) | | | | | | | | 3281 | 3281 | 3281 | 7433 | 7433 | 7433 | | | | | | | | | | | | | | | | | | | | | |
| | Wind Speed (knot) | 20 | | | 70 | 20 | 70 | 70 | | | | 70 | 70 | 70 | | | | 69 | 69 | 59 | 68 | 68 | 7 | 80 | 11 | 11 | 83 | 74 | 11 | 68 | 68 | 7 | | | |
| | Storm Surge (ft) | 3.5 | | | | | | | | | | 2.5 | 2.5 | 2.5 | 3 | е | e | 1.85 | 1.85 | 1.85 | 2.48 | 2.48 | 2.7 | 3.52 | 32 | 3.2 | 3.8 | 2.97 | 3.2 | 2.48 | 2.48 | 2.7 | | | |
| | Current (knot) | 1.80 | | | 1.8 | 1.8 | 1.8 | 1.8 | | | | 2.13 | 2.45 | 2.06 | | | | 1.35 | 1.35 | 1.35 | 1.67 | 1.67 | 1.75 | 2.08 | 1.95 | 1.95 | 2.18 | 1.87 | 1.95 | 1.67 | 1.67 | 1.75 | | | |
| | Time Period (sec) | 12.5 | | | 12.5 | 12.5 | 12.6 | 12.5 | | | | 12.5 | 12.5 | 12.5 | 13 | 13 | 13 | 11.5 | 11.5 | 11.5 | 12.2 | 12.2 | 12.4 | 13 | 12.8 | 12.8 | 13.3 | 12.6 | 12.8 | 12.2 | 12.2 | 12.4 | | | |
| | Wave Height (ft) | 61 | | | 59.4 | 57.9 | 53.5 | 43.8 | | | | 61.5 | 58.4 | 62.3 | 58.1 | 63.5 | 68.3 | 45 | 45 | 45 | 52.5 | 52.5 | 55 | 62.5 | 99 | 60 | 65 | 57.5 | 60 | 52.5 | 52.5 | 10 | 60.85 | 60.85 | 60.85 |
| Γ | Lower Deck Elev. | 46.5 | 51 (TOS) | 51 (TOS) | 47.5 | 47.5 | 47.5 | 47.5 | 52.0 | 52.0 | 62.0 | 44 | 44 | 44 | 52.5 | 52.5 | 62.5 | 54.25 | 64.25 | 54.25 | 29 | 29 | 29 | 33 | 33 | 33 | 36.75 | 36.75 | 36.75 | 34.5 | 34.5 | 34.5 | 37 | 37 | 37 |
| , | Air (ft) | 5.7 | <102 (| <102 (| 7.3 | 7.3 | 7.3 | 7.3 | | | | 32 | 3.2 | 32 | 11.7 | 11.7 | 11.7 | 4 | 4 | 12 | -8.2 | -8.2 | -8.2 | -5.4 | ά. 4 | -5.4 | 1.95 | 1.95 | 1.95 | -2.7 | -2.7 | -2.7 | 4 | 4 | 4 |
| ATION | ber of ick tions | | | * | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | 3 | 3 | 3 | 3 | | 3 | 3 | е | 3 | 3 | | 3 | 3 | | | | | |
| ⁵ ORM | 9 Eleva | | | | | | | | | | | | | | | | | | | | | | | | | | | | | - | - | | | | |
| KIN | Deck Le Spacing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Size | | | | (DD) (DD) | (DD) | (DD) | (DD) | | | | | | | | | | SD) (CD) (MD) | SD) WD) | SD) (CD) MD) | (SC) (MD) | Q () () () | (CD) | (SC) (MD) | (SC) | (CD) (MD) | (SD) (MD) | (CD) | (SD) (CD) | (SD) (MD) | (CD) | (CD) | | | |
| | Deck | | | | 136×72 136×72 | 136×72 136×72 | 136×72 136×72 | 136×72 136×72 | | | | | | | | | | 40x80 40x112 45x105 | 40x80 40x112 45x105 | 40x80 40x112 45x105 | 22×34.3 40×115 40'×148 | 22×34.3 40×115 40'×148 | 40'X148 40'X115 40'X148 | 22'x41' 43'X118 43'X151 | 22'x41' 43'X118 43'X151 | 22%41' 43%118 43%151 | 30.5×42 46.×133 46`×1513 | 30.5×42 46.×133 46`×151 | 30.5×42 46.'×133 46'×151 | 22'x32 46'x150 46'x150 | 22'x32 46'x150 46'x150 | 22'x32 46'x150 46'x150 | | | |
| ⊢ | t Lctor | | | | | 4 | | 4 | | | | 8 | | | | | | | | 0 | | | | | | | 5 | N | 2 | | | | 2 | 0 | 2 |
| | 5050 | Ň | | | - | | | | | | | | | | | | - | - | | | | | | | | | | | | | | ~ | ÷ | ÷ | ÷ |
| | Cor | | | | | | - | + | | | | - | - | - | - | - | | - | - | - | * | w | 8 | | w | | | - | 4 | 8 | w | | | | |
| _ | Pile Nr WT Cor (in) | | | | 1.375 | 1.375 | 1.375 1 | 1.375 1 | | | | • | - | - | - | - | | 0.75 (ML) | 0.75 1 (ML) 1 | 0.75 1 (ML) | 1.11 E | 1.11 (ML) 8 | 1.11 8 (ML) 8 | 1.375 | 1.375 8 | 1.375 | 1.375 (ML) | 1.375 1 (ML) 1 | 1.375 1: (ML) 1: | 0.75 8 (ML) 8 | 0.75 (ML) 8 | 0.75 (ML) | 1.0 (ML) | 1.0 (ML) | 1.0 (ML) |
| ATION | Pile Pile Nt OD WT Cor (in) Cor | 48(P) 42(S) | | | 42 1.375 | 42 1.375 | 42 1.375 1 | 42 1.375 1 | | | | 48 | 48 | 48 | 60 | 60 | 8 | 30 0.75 1 (ML) | 30 0.75 1 (ML) 1 | 30 0.75 1 (ML) 1 | 33 1.11 E | 33 1.11 8 (MlL) 8 | 33 1.11 8 (ML) 8 | 36 1.375 | 36 1.375 8 | 36 1.375 6 | 36 1.375 (ML) | 36 1.375 1 (ML) 1 | 36 1.375 1: (ML) 1: | 30 0.75 B | 30 0.75 E | 30 0.75 (ML) | 30 1.0 (ML) | 30 1.0 (ML) | 30 1.0 (ML) |
| ORMATION | tration OD WT Cor | 0-340 48(P) 42(S) | | | 340 42 1.375 | 340 42 1.375 | 340 42 1.375 1 | 240 42 1.375 1 | | | | 180 48 1 | 180 48 | 180 48 | 60 | 60 | 8 | 175 30 0.75 1 (ML) | 175 30 0.75 1 (ML) 1 | 175 30 0.75 1 (ML) 1 | 340 33 1.11 E | 240 33 1.11 E (ML) | 240 33 1.11 8 (ML) 8 | 36 36 1.375 | 365 36 1.375 8 | 865 36 1.375 8 | 150 36 1.375 . | 150 36 1.375 1 (ML) | 150 36 1.375 1: | 197 30 0.75 8 (ML) 8 | 197 30 0.75 8 | 197 30 0.75 (ML) | 180 30 1.0 (ML) | 180 30 1.0 (ML) | 180 30 1.0 (ML) |
| S INFORMATION | ar Actual Pile Pile Pile Ni Penetration OD WT Cor (ft) (in) (in) Cor | 320-340 48(P) 42(S) | | | 240 42 1.375 | 240 42 1.375 | 240 42 1.375 1 | 240 42 1.375 1 | | | | 180 48 1 | 180 48 | 180 48 | 60 | 00 | 8 | 175 30 0.75 1 (ML) | 175 30 0.75 1 (Mil.) | 175 30 0.75 1 (MiL) | 240 33 1.11 E | 240 33 1.11 ε | 240 33 1.11 8 (ML) 8 | 265 36 1.375 | 265 36 1.375 8 | 265 36 1.375 8 | 150 36 1.375 (ML) | 150 36 1.375 1 (ML) | 150 36 1.375 1: | 197 30 0.75 8 (ML) 8 | 197 30 0.75 E | 197 30 0.75 (ML) | 180 30 1.0 (Mil.) | 180 30 1.0 (ML) | 180 30 1.0 (ML) |
| PILES INFORMATION | Number Actual Pile Pile Pile Nt of Leg Penetration OD WT Cor Piles (ft) (in) (in) Cor | 8 320-340 48(P) 42(S) | | 8 | 8 240 42 1.375 | 8 240 42 1.375 | 8 240 42 1.375 1 | 8 240 42 1.375 1 | | | | 1 180 48 | 8 180 48 | 8 180 48 | 8 00 | 8 | 8 | 8 175 30 0.75 1 | 8 175 30 0.75 1 (MiL) | 8 175 30 0.75 1 (ML) | 8 240 33 1.11 E | 8 240 33 1.11 £ | 8 240 33 1.11 8 (ML) 8 | 8 265 36 1.375 | 8 285 38 1.375 8 | 8 265 36 1.375 8 | 8 150 36 1.375 . | 8 150 36 1.375 1 (ML) | 8 150 36 1.375 1: | 8 197 30 0.75 8 | 8 197 30 0.75 E | 8 197 30 0.75 (ML) | 8 180 30 (ML) | 8 180 30 1.0 (ML) | 8 180 30 1.0 (ML) |
| PILES INFORMATION | Vumber Number Actual Pile Pile Pile Nt of Vumber Actual Pile Pile Vut Vart of Leg Penetration OD WT Piles (in) (in) Cor | 4 8 320-340 48(P) | 0 | 8 | 0 8 240 42 1.375 | 0 8 240 42 1.375 | 0 8 240 42 1.375 1 | 0 8 240 42 1.375 1 | | | | 8 8 180 48 1 | 8 8 48 48 | 8 8 48 | 00 8 0 | 09 | 8 | 0 8 175 30 0.75 1 (ML) | 0 8 175 30 0.76 1 | 0 8 175 30 0.75 1 | 0 8 240 33 1.11 E | 0 8 240 33 1.11 E | 0 8 240 33 1.11 8 | 0 8 265 36 1.375 | 0 8 285 36 1.375 8 | 0 8 265 36 1.375 8 | 0 8 150 36 ^{1.375} . | 0 8 150 36 1.375 1 (ML) | 0 8 150 38 1.375 1: | 0 8 197 30 0.75 8 | 0 8 197 30 0.75 8 | 0 8 197 30 0.75 (ML) | 0 8 180 30 1.0 (MIL) | 0 8 180 30 1.0 (ML) | 0 8 180 30 1.0 (ML) |
| PILES INFORMATION | ries Number Number Actual Pile Pile Pile Nu outed Skirt of Leg Penetration OD WT Cor sNo.) Piles (ft) (in) (in) Cor | res 4 8 320-340 48(P) 42(S) | No 8 8 | No 8 8 | No 0 8 240 42 1.375 | No 0 8 240 42 1.375 . | No 0 8 240 42 1.375 1 | No 0 8 240 42 1.375 1 | No | No | No | No 3. Pils- 8 8 180 48 1 (es) | No 8 8 48 | No 8 8 180 48 | No 0 8 00 | No 0 8 00 | 00 00 8 00 00 00 00 00 00 00 00 00 00 00 | res 0 8 175 30 0.75 1 | res 0 8 175 30 0.75 1 | fes 0 8 175 30 0.75 1 | res 0 8 240 33 1.11 E | fes 0 8 240 33 1.11 ε | Yes 0 8 240 33 1.11 8 | res 0 8 265 36 1.375 | res 0 8 285 38 1.375 E | res 0 8 265 36 1.375 6 | res 0 8 150 36 1.375 . | res 0 8 150 36 1.375 1 (MU) | fes 0 8 150 36 1.375 1: | No 0 8 197 30 0.75 8 | No 0 8 197 30 0.75 8 | No 0 8 197 30 0.75 (ML) | res 0 8 180 30 (ML) | res 0 8 180 30 1.0 (ML) | 10 8 180 30 1.0 (ML) |
| PILES INFORMATION | nt Piles Number Number Actual Pile Pile Pile Nu of Grouted Skit of Leg Penetration OD WT Cor No) (YesNo) Piles (ft) (in) (in) Cor | Yes 4 8 320-340 48(P) | 8 8 | No 8 8 | s No 0 8 240 42 1.375 | s No 0 8 240 42 1.375 . | s No 0 8 240 42 1.375 1 | s No 0 8 240 42 1.375 1 | ON N | N | No | No (Skt Pis- Yes) 8 8 180 48 1 | No 8 8 48 48 | No 8 180 48 | s No 0 8 60 | s No 0 8 60 | . 00 8 0 | * Yes 0 8 175 30 0.75 1 | s Yes 0 8 175 30 0.75 1 | -s Yes 0 8 175 30 0.75 1 | s Yes 0 8 240 33 1.11 E | s Yes 0 8 240 33 1.11 6 (ML) 6 | s Yes 0 8 240 33 1.11 8 | s Yes 0 8 285 36 1.375 | s Yes 0 8 265 36 1.375 E | s Yes 0 8 265 36 1.375 8 | s Yes 0 8 150 36 1.375 . | s Yes 0 8 150 36 1.375 1 | -s Yes 0 8 150 36 1.375 1: | s No 0 8 197 30 0.75 8 | s No 0 8 197 30 0.75 8 | s No 0 8 197 30 0.75 (ML) | s Yes 0 8 180 30 (.0.1.) | s Yes 0 8 180 30 (ML) | s Yes 0 8 180 30 1.0 |
| PILES INFORMATION | Joint Page Number Number Number Actual Pile Pile Pile Pile Nu 1 Can Grouted of Vietual Pile Pile Pile Pile Pile Vietual Vietual Vietual Vietual Vietual Vietual Vietual Vietual Vietual Con Vietual Con Vietual Con Vietual Con Vietual Con Con Vietual Con Con </th <th>Yes 4 8 320-340 48(P)</th> <th>00 00 00</th> <th>8 8</th> <th>Yes No 0 8 240 42 1.375 .</th> <th>Yes No 0 8 240 42 1.375 .</th> <th>Yes No 0 8 240 42 1.375 1</th> <th>Yes No 0 8 240 42 1.375 1</th> <th>N</th> <th>No</th> <th>No</th> <th>(Skit. Pis- Yes) 8 180 48 1 Yes) 8 180 48</th> <th>8 8 180 180 180 180 180 180 180 180 180</th> <th>8 8 180 180 180 180 180 180 180 180 180</th> <th>Yes No 0 8 60</th> <th>Yes No 0 8 60</th> <th>Yes No 0 8 00</th> <th>Yes Yes 0 8 175 30 0.75 1</th> <th>Yes Ves 0 8 175 30 0.75 1</th> <th>Yes Yes 0 8 175 30 0.75 1</th> <th>Yes Yes 0 8 240 33 1.11 6</th> <th>Yes Yes 0 8 240 33 1.11 6</th> <th>Yes Yes 0 8 240 33 1.11 8</th> <th>Yes Yes 0 8 265 36 1.375</th> <th>Yes Ves 0 8 265 36 1.375 8</th> <th>Yes Yes 0 8 285 38 1.375 8</th> <th>Yes Yes 0 8 150 36 1.375</th> <th>Yes Yes 0 8 150 36 1.375 1</th> <th>Yes Yes 0 8 150 36 1.375 1:</th> <th>Yes No 0 8 197 30 0.75 8</th> <th>Yes No 0 8 197 30 0.75 6</th> <th>Yes No 0 8 197 30 0.75 (ML)</th> <th>Yes Yes 0 8 180 30 1.0 (ML)</th> <th>Yes Yes 0 8 180 30 1.0 (ML)</th> <th>Yes Yes 0 8 180 30 1.0 (ML)</th> | Yes 4 8 320-340 48(P) | 00 00 00 | 8 8 | Yes No 0 8 240 42 1.375 . | Yes No 0 8 240 42 1.375 . | Yes No 0 8 240 42 1.375 1 | Yes No 0 8 240 42 1.375 1 | N | No | No | (Skit. Pis- Yes) 8 180 48 1 Yes) 8 180 48 | 8 8 180 180 180 180 180 180 180 180 180 | 8 8 180 180 180 180 180 180 180 180 180 | Yes No 0 8 60 | Yes No 0 8 60 | Yes No 0 8 00 | Yes Yes 0 8 175 30 0.75 1 | Yes Ves 0 8 175 30 0.75 1 | Yes Yes 0 8 175 30 0.75 1 | Yes Yes 0 8 240 33 1.11 6 | Yes Yes 0 8 240 33 1.11 6 | Yes Yes 0 8 240 33 1.11 8 | Yes Yes 0 8 265 36 1.375 | Yes Ves 0 8 265 36 1.375 8 | Yes Yes 0 8 285 38 1.375 8 | Yes Yes 0 8 150 36 1.375 | Yes Yes 0 8 150 36 1.375 1 | Yes Yes 0 8 150 36 1.375 1: | Yes No 0 8 197 30 0.75 8 | Yes No 0 8 197 30 0.75 6 | Yes No 0 8 197 30 0.75 (ML) | Yes Yes 0 8 180 30 1.0 (ML) | Yes Yes 0 8 180 30 1.0 (ML) | Yes Yes 0 8 180 30 1.0 (ML) |
| PILES INFORMATION | DverLap Joint Piles Number Number Actual Pile Pile Pile N Vuolinis) Can Grouted of Number Actual Pile Pile Pile WT scNONA) (YesNo) (YesNo) (YesNo) Piles Piles (ff) (in) (in) Cor | Yes 4 8 320-340 48(P) | 00 00 | 8 8 | Yes No 0 8 240 42 1.375 | Yes No 0 8 240 42 1.375 . | Yes No 0 8 240 42 1.375 1 | Yes No 0 8 240 42 1.375 1 | No | 2 | No | No (Ski Piese 8 180 48 Yes) 48 8 180 48 | No 884 884 884 884 884 884 884 884 884 88 | No 8 8 48 48 48 48 48 48 48 48 48 48 48 48 | NA Yes No 0 8 60 | NA Yes No 0 8 60 | NA Yes No 0 8 60 | No Yes Yes 0 8 175 30 0.75 1 | No Yes Yes 0 8 175 30 0.75 1 | No Yes Yes 0 8 175 30 0.75 1 | Yes Yes Yes 0 8 240 33 1.11 6 | Yes Yes Yes 0 8 240 33 1.11 8 | Yes Yes Yes 0 8 240 33 1.11 8 | Yes Yes Yes 0 8 265 36 1.375 | Yes Yes Yes 0 8 285 38 1.375 8 | Yes Yes Yes 0 8 265 38 1.375 8 | Yes Yes Yes 0 8 150 36 1.375 . | Yes Yes Yes 0 8 150 38 1.375 1 | Yes Yes Yes 0 8 150 36 1.375 1: | No Yes No 0 8 197 30 0.75 8 | No Yes No 0 8 197 30 0.75 8 (MIL) | No Yes No 0 8 197 30 (ML) | Yes Yes Yes 0 8 180 30 (MIL) | Yes Yes Yes 0 8 180 30 1.0 (ML) | Yes Yes Yes 0 8 180 30 1.0 (ML) |
| I PILES INFORMATION | OverLap Joint Piles Number Number Actual Pile Pile Pile Number Number Actual Pile Pile Number Number Actual Pile Pile Pile Virol Control Can Geouted Skit of Lag Penetration OD WT Control (YoesNo) Piles Piles Piles (ft) (in) (in) Control Can Can Can Can Can Can Can Can Can Can | 2 Yes 4 8 220-340 48(P) 42(S) | 00 00 00 | No 8 8 | 2 Yes No 0 8 240 42 1.375 | 2 Yes No 0 8 240 42 1.375 . | 2 Yes No 0 8 240 42 1.375 1 | 2 Yes No 0 8 240 42 1.375 1 | 9 | 2 2 | No | K3 K9 K9 8 8 190 48 1 (SK1 Pis- 8 8 190 48 1 Ves) | K3 8 8 48 48 | K3 8 8 48 48 | NA Yes No 0 8 60 | NA Yes No 0 8 80 | NA Yes No 0 8 60 | (No Yes 0 8 175 30 0.75 1 | (No Yes Ves 0 8 175 30 0.75 1 | (No Yes Yes 0 8 175 30 0.75 1 | (Yes Yes 0 8 240 33 1.11 6 | (Yes Yes Yes 0 8 240 33 1.11 8 | (Yes Yes Yes 0 8 240 33 1.11 8 | Yes Yes 0 8 285 36 1.375 | Yes Yes 0 8 265 36 1.375 8 | Yes Yes Yes 0 8 205 36 1.375 8 | Yes Yes O 8 1.375 (ML) 36 (ML) 36 1.375 | Yes Yes 0 8 1.375 1 (Mil) (Mil) (Mil) (Mil) 1 | Yes Yes Yes 0 8 150 36 1.375 11 | (No Yes No 0 8 197 30 0.75 8 | (No Yes No 0 8 197 30 0.75 (ML) | (No Yes No 0 8 197 30 0.75 (ML) | (Yes Yes Yes 0 8 180 30 (MIL) | (Yes Yes Yes 0 8 180 30 1.0 (MIL) | (Yes Yes Yes 0 8 190 30 1.0 (ML) |
| ATION PILES INFORMATION | Trans. Overtup Joint Pites Number Number Actual Pile Pile Pile M Bracing (Kabihis) Car Goruda Sert OLeg Penetration CO WT Cor S.S.K.132](YerkiNoku) (YeskiNo) Piles Piles Piles Piles Piles (III) (IIII) (III) (II | K1/X2 Yes 4 8 320-340 42(S) | 00 00 00 00 | X 8 8 | K1,K2 Yes No 0 8 240 42 1.375 | K1/K2 Yes No 0 8 240 42 1.375 . | K1K2 Yes No 0 8 240 42 1.375 1 | K1,K2 Yes No 0 8 240 42 1.375 1 | K2 V0 | K2 No | K2 No | SD.X.K3 [Skit.Pis. 8 8 190 48 1 Yes) Yes | SDXK3 No 8 8 180 48 | SDXK3 No 8 8 180 48 | X NA Yes No 0 8 60 | X NA Yes No 0 8 60 | X NA Yes No 0 8 00 | K1,X No Yes 0 8 175 30 0.75 1 | K1X No Yes Yes 0 8 175 30 0.75 1 | K1X No Yes Yes 0 8 175 30 0.75 1 | K1X Yes Yes Ves 0 8 240 33 1.11 E | K1X Yes Yes Yes 0 8 240 33 1.11 8 | K1.X Yes Yes Yes 0 8 240 33 1.11 8 | K2 Yes Yes 0 8 265 36 1.375 | K2 Yes Yes 0 8 285 38 1.375 8 | K2 Yes Yes Yes 0 8 265 36 1.375 8 | K2 Ves Yes Yes 0 8 150 36 (1.375 (ML) | K2 Yes Yes 0 8 150 38 1.375 1 | K2 Yes Yes Ves 0 8 150 36 1.375 1: | K1.X No Yes No 0 8 197 30 0.75 8 | K1X No Yes No 0 8 197 30 075 8 | K1X No Yes No 0 8 197 30 0.75 (MIL) | K1X Yes Yes 0 8 180 30 1.0 | K1X Yes Yes 0 8 180 30 1.0 | K1,X Yes Yes Yes 0 8 180 30 1.0 (ML) |
| ORMATION PILES INFORMATION | rgu. Trans. Overlag. Joint Piss. Number Number Actual Pis Pis Pis W Control Barran Piss. Developed Surf. 10-14 Press. Piss. | X K1,K2 Yes 4 8 320-340 48(P) | 8 8 0N X XC | 8 8 9N X XC | D K1.K2 Yes No 0 8 240 42 1.375 | 20 K1,K2 Yes No 0 8 240 42 1.375 . | 20 K1.K2 Yes No 0 8 240 42 1.375 1 | 20 K1,K2 Yes No 0 8 240 42 1.375 1 | oN 201 XC | ow sx xc | ov zv xc | No. No. No. 48 180 48 1 Yes Yes 8 8 180 48 1 | - 100 8 8 48 48 48 48 48 48 48 48 48 48 48 48 | -K3 SDXK3 No 8 8 180 48 | - 00 8 0 0N sey VN X XC | t 00 8 0 oN sey AN X XC | . 08 8 0 0N say NN X XC | 1 (1W) (1W) (12 (12 (12 (12 (12 (12 (12 (12 (12 (12 | D K1X No Yes Ves 0 8 175 30 0.75 1 | 20 K1X No Yes Yes 0 8 175 30 0.75 1 | 3 11:1 (1W) 240 8 0 8 10:1 33 11:1 C | 20 K1X Yes Yes 0 8 240 33 1.11 8 | 8D K1X Yes Yes Yes 0 8 240 33 111 8 | 1. K2 Ke Yes Yes 0 8 265 36 1.375 | VC2 Ves Ves Ves 0 8 265 36 1.375 8 | .K2 K2 Yes Yes Yes 0 8 265 36 1.375 8 | NC Yes Yes Yes 0 8 1.375 1.375 | .K2 K2 Yes Yes 0 8 150 36 1.375 1 | .K2 K2 Yes Yes Yes 0 8 150 36 1.375 11 | 20 K1X No Yes No 0 8 197 30 0.75 8 | 20 K1X No Yes No 0 8 197 30 0.75 (AL) | D K1X No Yes No 0 8 197 30 0.75 | 0.1 0E 0Bi 8 0 say say say x.t.X X.c | X Yes Yes 0 8 10 <th10< th=""> 10 10 10<th>X K1X Yes Yes Ves 0 8 180 30 1.0 (ML)</th></th10<> | X K1X Yes Yes Ves 0 8 180 30 1.0 (ML) |
| ET INFORMATION PILES INFORMATION | Long. Trans. OverLap Joint Pies Number Number Actual Pie Pie Pie Ni Bracing Bracing (Nuchol Joint Piese Number Number Actual Pie Pie Pie Ni (SDXXIVS)(SDXXIV2)(PierkoNA) (resko) Pies Pies Pies Pies (10) (n) (n) Con- (SDXXIVS)(SDXXIV2)(PierkoNA) (resko) Pies (10) (10) (10) (10) | 5 SDX K1K2 Yes 4 8 220-340 42(S) | SDX X 8 8 | SDX X No 8 8 | SD W1/K2 Yes No 0 8 240 42 1.375 | SD K1,K2 Yes No 0 8 240 42 1.375 . | SD K1.K2 Ves No 0 8 240 42 1.375 1 | SD K1,K2 Yes No 0 8 240 42 1.375 1 | SDX K2 No | SDX K2 No No | SDX K2 No | - SD,K3 SD,X,K3 (SKLPR- 8 8 180 48 1 Yes) Yes | SD,K3 SDX,K3 No 8 8 48 48 | SD,K3 SD,X,K3 No 8 8 180 48 | SDX X NA Yes No 0 8 60 1 | SDX X NA Yes No 0 8 60 | SDX X NA Yes No 0 8 60 | T C N K1X NO Yes 0 8 175 30 0.75 1 (0.00) | SD K1X No Yes 0 8 175 30 0.75 (ML) 1 | - SD K1X No Yes Yes 0 8 175 30 0.75 1 | - SD K1X Yes Yes 0 8 240 33 1.11 8 | SD K1X Yes Yes 0 8 240 33 1.11 (ML) 8 | SD K1X Yes Yes Yes 0 8 240 33 1.11 8 | SD.K2 K2 Yes Yes 0 8 285 36 1.375 | SD.K2 Ycs Yes 0 8 265 36 1.375 8 | SD.K2 K2 Yes Yes Yes 0 8 285 36 1.375 8 | - SD,K2 K2 Yes Yes Ves 0 8 150 36 1.375 . | SD/K2 K2 Yes Yes 0 8 150 36 1.375 1 | SD.K2 K2 Yes Yes Yes 0 8 150 36 1.375 1: | i SD K1X No 0 8 197 30 0.75 8 | 3 (100) 101 101 101 101 101 101 101 101 101 | (SD K1X No Yes No 0 8 197 30 0.75 | SDX K1X Yes Yes Yes 0 8 180 30 10 (MI) | - SDX K1X Yes Yes Ves 0 8 180 30 1.0 | - SDX K1X Yes Yes Yes 0 8 190 30 10 |
| ACKET INFORMATION PILES INFORMATION | Trans. Long. Trans. Overlag Joint Pies Number Number Actual Pies Pie Pie Pie Bate Manaler Number Actual Pies Pie Pie Pie Pies Pies Piese P | 1 in 7.86 SDX K1/K2 Yes 4 8 220-340 43(P) 42(S) | SDX X 8 8 | SDX X No 8 8 | SD K1,K2 Ves No 0 8 240 42 1375 | SD K1,K2 Yes No 0 8 240 42 1.375 . | SD K1K2 Yes No 0 8 240 42 1375 1 | SD K1/K2 Yes No 0 8 240 42 1.375 1 | SDX K2 No | No N | SDX K2 No | 1 in 10 SD,K3 SD,X,K3 (SK1,Pis- 8 8 190 48 1 Yes Yes 8 190 48 1 | 1 in 10 SD,K3 SD,X/3 No 8 8 180 48 | 1 in 10 SD.K3 SD.X/K3 No 8 8 180 48 | 1 in 8 SDX X NA Yes No 0 8 00 | 1 h 8 SDX X NA Yes No 0 8 60 | 1 h 8 SDX X NA Yes No 0 8 60 | t in t5 SD 175 No No Yes Ves 0 8 175 30 275 1 in t | T in 15 SD K1X No Yes 0 8 175 30 0.75 (MU) 1 | T in 15 SD K1 X No Yes 0 8 175 30 0.75 1 | 1 11 1 2 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 | Tin 10 SD K1X Yes Yes 0 8 240 33 1,11 (M0,) 8 | 1 in 10 SD K1X Yes Yes 0 8 240 33 1.11 8 | 1 h 9 SD,K2 K2 Yes Yes 0 8 285 36 1.375 | 1 h 9 SD,K2 K2 Yes Yes 0 8 285 36 1.375 8 | 1 in 9 SD/K2 K2 Yes Yes 0 8 285 38 1.375 8 | T in 10 SD,KZ KZ Yes Yes 0 8 1.375 1.375 1.375 1.401 36 1.375 1.401 36 1.375 1.401 1.401 1.401 | T in 10 SD,K2 K2 Yes Yes 0 8 150 35 1,375 1 | 1 in 10 SD,K2 K2 Yes Yes Yes 0 8 150 36 1.375 1: | 1 in 12 SD K1 X No Yes No 8 197 30 (35 8 | 1 in 12 SD K1X No Yes No 0 8 197 30 0.75 8 | 1 in 12 SD K1 X No Yes No 8 197 30 0.75 (MA) Vision Vision | 1 in 10 SDX W1X Yes Yes Yes 0 8 180 30 10 | 1 in 10 SDX K1X Yes Yes 0 8 180 30 1.0 (ML) | 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 (MI) |
| JACKET INFORMATION PILES INFORMATION | Long. Trans. Long. Trans. Overlap Joint Piss Number Number Number Natasita Piss Piss Pis Piss Piss Piss Piss Piss | In 7.86 1 in 7.86 5D X K1 K2 Yes 4 8 220-340 4.8(P) 4.3(S) | 8 N N N N N N N N N N N N N N N N N N N | SDX X No 8 8 | SD K1/K2 Yes No 0 8 240 42 1375 | SD K1,K2 Yes No 0 8 240 42 1.375 . | SD K1,K2 Ves No 0 8 240 42 1.376 1 | SD K1,K2 Yes No 0 8 240 42 1.375 1 | SDX K2 No | SDX K2 M0 | SDX K2 No | 1 in 10 1 in 10 SD,K3 SDX,K3 [Skt.Pks 8 8 180 48 1 | 1 in 10 1 in 10 SD,K3 SD,X43 No 8 8 180 48 | 1 in 10 1 in 10 SD,K3 SD,X43 No 8 8 180 48 | 1in8 1in8 SDX X NA Yes No 0 8 60 1 | 1in8 1in8 SDX X NA Yes No 0 8 60 1 | 1in8 1in8 SDX X NA Yes No 0 8 60 | 0 11in 15 SD K1X No Yes Yes 0 8 175 30 0.75 1 | 0 1115 SD K1X No Yes Yes 0 8 175 30 075 1 | 0 1 in 15 SD K1X No Yes Ves 0 8 175 30 0.75 1 | 1 in 10 1 in 10 SD K1X Yes Yes Yes 0 8 240 33 1.11 640. | Initio Initio SD KLX Yes Yes 0 8 240 33 111 (MM) 8 | 1 in 10 1 in 10 SD K1X Yes Yes 0 8 240 33 1.11 8 | 1 in 9 SD, 42 Yes Yes 0 8 285 36 1375 | 1n9 1n9 SD/K2 Yes Yes Yes 0 8 285 36 1375 6 | 1in 9 1in 9 <th< th=""><th>1 in 10 1 in 10 SD/X2 K2 Yes Yes 0 8 150 36 150 36 1. (JM)</th><th>T in 10 T in 10 SD/K2 Yes Yes 0 8 1.375 1.375 1 <th1< th=""> 1 1 <th1<< th=""><th>1 in 10 1 in 10 SD,K2 K2 Yes Yes Yes 0 8 150 36 1.375 1:</th><th>0 11in 12 SD K1,X No Yes No 0 8 197 30 0.75 8</th><th>0 1 in 12 SD K1X No Yes No 0 8 197 30 0.75 8</th><th>0 1 ln 12 SD K1X No Yes No 8 197 30 0.75 (MI)</th><th>1 in 10 1 in 10 SD.X K1.X Yes Yes 0 8 180 30 1.0</th><th>1 in 10 1 in 10 SDX K1 X Yes Yes 0 8 180 30 1.0</th><th>1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 (ML)</th></th1<<></th1<></th></th<> | 1 in 10 1 in 10 SD/X2 K2 Yes Yes 0 8 150 36 150 36 1. (JM) | T in 10 T in 10 SD/K2 Yes Yes 0 8 1.375 1.375 1 <th1< th=""> 1 1 <th1<< th=""><th>1 in 10 1 in 10 SD,K2 K2 Yes Yes Yes 0 8 150 36 1.375 1:</th><th>0 11in 12 SD K1,X No Yes No 0 8 197 30 0.75 8</th><th>0 1 in 12 SD K1X No Yes No 0 8 197 30 0.75 8</th><th>0 1 ln 12 SD K1X No Yes No 8 197 30 0.75 (MI)</th><th>1 in 10 1 in 10 SD.X K1.X Yes Yes 0 8 180 30 1.0</th><th>1 in 10 1 in 10 SDX K1 X Yes Yes 0 8 180 30 1.0</th><th>1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 (ML)</th></th1<<></th1<> | 1 in 10 1 in 10 SD,K2 K2 Yes Yes Yes 0 8 150 36 1.375 1: | 0 11in 12 SD K1,X No Yes No 0 8 197 30 0.75 8 | 0 1 in 12 SD K1X No Yes No 0 8 197 30 0.75 8 | 0 1 ln 12 SD K1X No Yes No 8 197 30 0.75 (MI) | 1 in 10 1 in 10 SD.X K1.X Yes Yes 0 8 180 30 1.0 | 1 in 10 1 in 10 SDX K1 X Yes Yes 0 8 180 30 1.0 | 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 (ML) |
| JACKET INFORMATION PILES INFORMATION | mitter Long. Trans. Long. Trans. Overlap. Joint Pites Number Neumer Actual Pite. Pite Pite Pite Pite Univer Long. Trans. Berlang Benerge Rockombs Joint Consol Sant Carlos Parenersion CO WT Correlation Santer Bastine Statics (SSX:KIC)(SSX:KIC)(ForeNovie) (ForeNov) pites | 6 1 in 7.88 1 in 7.88 SDX K1X2 Yes 4 8 320-340 4.8P) 4.8S | 6 8 8 8 8 | 6 SDX X No 8 8 | 5 SD K1/K2 Yes No 0 8 240 42 1375 | 5 SD K1/K2 Ves No 0 8 240 42 1375 . | 5 SD K1,K2 Yes No 0 8 240 42 1375 1 | 5 SD K1,K2 Yes No 0 8 240 42 1375 1 | 3 SDX K2 No | 3 SDX K2 N0 | 3 SDX K2 No | 4 1 in 10 SD/X/3 SD/X/3 SD/X/3 (String) 8 8 180 48 1 | 4 1 in 10 1 in 10 SD,K3 SD,X43 No 8 8 180 48 | 4 1 in 10 1 in 10 SD/K3 SDX/K3 No 8 8 180 48 | 5 1 in 8 1 in 8 SDX X NA Yes No 0 8 00 1 | 5 1 in 8 1 n 8 5D X X NA Yes No 0 8 60 1 | 5 1 in 8 5DX X NA Yee No 0 8 20 | 5 0 1 m 15 SD K1X No Yes Ves 0 8 175 30 0.075 | 5 0 1 m15 SD K1X No Yes Ves 0 8 175 30 076 1 M01 | 5 0 1 in 15 SD K1X No Yes Yes 0 8 175 30 0.75 1 | 4 11110 1101 SD K1X Yes Yes Yes 0 8 240 33 1111 8 | 4 1 in 10 1 in 10 SD K1 X Yes Yes Yes 0 8 240 33 1.11 8 | 4 1 in 10 1 in 10 SD K1X Yes Yes 0 8 240 33 1.11 8 | 5 1 in 9 10 km 20 km 768 768 768 768 285 38 1.375 | 5 1 in 9 SD,K2 K2 Yes Yes 0 8 285 36 1375 8 | 5 1 in 9 1 in 9 SD,K2 K2 Yes Yes 0 8 285 38 1.375 8 | 4 1 In 10 1 In 10 SD,KZ K2 Yes Yes Yes 0 8 150 36 1.375 (MU) | 4 1 m 10 1 m 10 SD/C2 K2 Yes Yes Yes 0 8 150 36 1.375 1 (MU) | 4 1 in 10 1 in 10 SD/K2 K2 Yes Yes Yes 0 8 150 36 1.375 1: (ML) | 4 0 1 in 12 SD K1X No 768 No 0 8 1078 30 (0.75 1 (0.11) 1 | 4 0 1 in 12 SD K1X No Yes No 0 8 197 30 075 8 | 4 0 1in12 SD K1X No Yes No 0 8 197 20 075 (ML) | 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 (MJ) | 5 1 in 10 1 in 10 SDX K1X Yes Yes 0 8 180 30 10 (ML) | 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 (MU) |
| JACKET INFORMATION PILES INFORMATION | Number Long, Trans. Long. Trans. Overlap. Joint Pate Number Number Actual Pile. Pile Number Long. Trans. Long. Received Decision (Received) Exception (Section) 2 and Counded Section (Decision) 2 and Pile Number Number Pile Pile Pile Number Long. Joint Pile Pile Pile Pile Pile Pile Pile Pile | 8 6 1 m 7.86 1 m 7.86 2 D X K1.K2 Yes 4 8 200.340 4.85 | 8 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | 8 6 8 8 8 | 8 5 SD K1,X2 Yes No 0 8 240 42 1.375 | 8 5 SD K1,K2 Yes No 0 8 240 42 1375 . | 8 5 SD K1/K2 Yes No 0 8 240 42 1.375 1 | 8 5 SD K1/K2 Yes No 0 8 240 42 1.375 1 | 8 3 SDX K2 No | 8 3 SDX K2 No | 8 3 SDX K2 No | 8 4 1 in 10 1 in 10 SD/X3 SD/X3 [Skt Piss 8 8 180 48 1 Yws; 1 | 8 4 1 in 10 1 in 10 SD,K3 SDX,K3 No 8 8 160 48 | 8 4 1 in 10 1 in 10 SDXK3 SDXK3 No 8 8 180 48 | 8 5 1 in 8 1 in 8 SDX X NA Yes No 0 8 00 1 | 8 5 1 1 n 8 1 n 8 2D X X NA Yes No 0 8 60 1 | 8 5 1 1 n 8 1 n 8 SDX X NA Yes No 0 8 80 | 8 5 0 1 in 15 SD K1X No Yes Yes 0 8 175 30 0.075 | 8 5 0 1 ln 15 SD K1X No Yes Yes 0 8 175 30 075 1 | 8 5 0 1 in 15 SD K1X No Yes Yes 0 8 175 30 0.75 1 | 8 4 1 in 10 1 in 10 SD K1X Yes Yes Yes 0 8 240 33 (11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 8 4 11110 11110 SD K1X Yes Yes 0 8 240 33 1111 6 (MJ) | 8 4 1 in 10 1 in 10 SD K1X Yes Yes Yes 0 8 240 33 1.11 8 | 8 5 1 in 9 1 n 9 SD, V2 K2 Yes Yes Yes 0 8 235 36 1.375 | 8 5 1 in 9 1 h 9 SD/K2 K2 Yes Yes 0 8 265 36 1.375 8 | 8 5 1 in 9 1 in 9 SD, K2 Kas Yes 0 8 265 36 1.375 4 | 8 4 1 in 10 1 in 10 SD.K2 K2 Yes Yes Yes 0 8 150 26 ^{1,375} (MU) | 8 4 1 in 10 1 in 10 SD/K2 K2 Yes Yes Yes 0 8 150 36 1375 1 (MU) | 8 4 1 in 10 1 in 10 SD/K2 K2 Yes Yes Yes 0 8 150 36 1.375 1: (MU) | 8 4 0 1 in 12 SD K1.X No Yes No 0 8 197 30 075 8 | 8 4 0 1 ln 12 SD K1X No Yes No 0 8 197 30 075 8 | 8 4 0 1 in 12 SD K1X No Yes No 8 197 30 075 | 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 (MU) | 8 5 1 lin 10 1 in 10 SDX K1X Yes Yes Ves 0 8 180 30 $\frac{1.0}{(ML)}$ | 3 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 1.0 (ML) |
| JACKET INFORMATION PILES INFORMATION | Pri Number Long, Trans, Long, Trans, Long, Trans, OverLep, Joint Pite, Number Number Long, Trans, Long, Trans, Core and Biolic Bioli | 8 6 1 in 7.86 SD X K1 K2 Yes 4 8 200-340 44(S) | 00 00 00 00 00 00 00 00 00 00 00 00 00 | 8 6 No 8 8 | 8 5 1 SO K1X2 Yes No 0 8 240 42 1375 | 8 5 X1X2 Yes No 0 8 240 42 1375 . | 8 5 SD K1,K2 Yes No 0 8 240 42 1.375 1 | 8 5 SD K1,K2 Yes No 0 8 240 42 1375 1 | 5 8 3 SDX K2 N0 | 8 3 50 X 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 | 5 8 3 SDX K2 No | 0 8 4 1 m 10 1 m 10 SD/X SDX/X3 SDX/X3 1 SAL Pic 8 8 1 80 48 1 m 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 8 4 1 m 10 1 m 10 SD/KS SDX/KS 8 8 8 8 4 | 8 4 1m10 1m10 SD/K3 SDX/K3 No 8 8 180 48 |) 8 5 1in8 1in8 SDX X NA Yes No 0 8 60 | 8 5 1 in 8 SDX X NA Yes No 0 8 50 1 10 1 | 8 5 1in8 1in8 SDX X NA Yes No 0 8 80 | 1 8 5 0 1m15 SD KIX No Yes Yes 0 8 175 30 0.075 1 (MU) | 1 8 5 0 1 ln 15 SD K1X NO Yes Yes 0 8 775 30 075 1 | 1 8 5 0 1 in 15 SD K1X No Yes Yes 0 8 775 30 0.75 1 | 1 8 4 1 m 10 1 m 10 SD K1X Yes Yes Yes 0 8 240 33 (MU) 8 | 5 8 4 1 in 10 SD K1X Yes Yes 0 8 200 33 111 6 (M) (M) (M) Yes Yes 0 8 200 33 (M) 8 | i 8 4 1 in 10 1 in 10 SD K1X Yes Yes 0 8 240 33 1.11 8 | 1 8 5 1 In 9 1n 9 XO 12 Yes Yes 0 8 235 30 1375 | 1 6 1 1 9 SD/K2 K2 Yes Yes 0 8 285 35 1.375 5 | 3 8 5 1 in 9 1 in 9 20,K2 K2 Yes Yes Yes 0 8 285 36 1375 8 | 7 8 4 1m10 1m10 SD/2 N2 N3 Yes Yes 0 8 150 36 1.375 (MX) | r 8 4 1in 10 1in 10 SD/R2 K2 Yes Yes 0 8 150 20 1375 1 (MU) | * 8 4 1 in 10 1 in 10 SD,K2 K2 Yes Yes 0 8 1.375 1: | 8 4 0 1 m12 SD VLX No Yes 0 8 0.75 Xet 0.0 0.75 <th0.75< th=""> 0.75 0.75 <th0< th=""><th>8 4 0 11n12 SD K1X No Yes No 8 197 30 0.75 8</th><th>8 4 0 11n12 SD K1X No Yes No 0 8 197 30 0.75 (MI) (MI)<</th><th>1 8 5 1 1 1 0 1 1 1 0 SDX K1X Yes Yes 0 8 190 30 10 (MU)</th><th>8 5 1 m 10 1 m 10 SDX K1X Yes Yes 0 8 180 30 1.0 (ML) (ML)</th><th>) 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 1.0 (ML)</th></th0<></th0.75<> | 8 4 0 11n12 SD K1X No Yes No 8 197 30 0.75 8 | 8 4 0 11n12 SD K1X No Yes No 0 8 197 30 0.75 (MI) (MI)< | 1 8 5 1 1 1 0 1 1 1 0 SDX K1X Yes Yes 0 8 190 30 10 (MU) | 8 5 1 m 10 1 m 10 SDX K1X Yes Yes 0 8 180 30 1.0 (ML) (ML) |) 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 1.0 (ML) |
| JACKET INFORMATION PILES INFORMATION | ¹ Water Muniber Long, Trans. Long. Trans. OverLap. Joint Pites Muniber Muniber Long, Trans. Long. Trans. OverLap. Joint Pites Muniber Muniber Muniber Long, Trans. Long. Trans. OverLap. OverLap. Joint Potes Muniber Mun | 300 8 6 1in 7.86 1in 7.86 SDX K1.K2 Yes 4 8 200-340 48(P) 43(S) | 345 8 00 X X XDS 9 8 CPE | 343 8 6 No 8 8 | 247 8 5 SD K1/X2 Yes No 0 8 240 42 1.375 | 247 8 5 SD K1,K2 Ves No 0 8 240 42 1.375 . | 247 8 5 SD K1K2 Yes No 0 8 240 42 1335 1 | 247 8 5 SD K1/K2 Yes No 0 8 240 42 1.375 1 | 125 8 3 SDX K2 No | 125 8 3 SDX K2 N0 | 125 8 3 SDX K2 No | 340 8 4 11m10 11m10 SDXX03 SDXX03 1340 8 8 8 180 48 | 340 8 4 11m10 11m10 SD/X/G No 8 8 150 46 | 340) 8 4 1 in 10 1 in 10 SDX/X3 SDX/X3 No 8 8 180 48 | 310 8 5 1 in 8 1 n 8 DX X NA Yes No 0 8 00 1 | 310 8 5 1in8 1h8 SDX X NA Yes No 0 8 60 | 3(0 8 5 1 in 8 1 h 8 5DX X NA 1 tes No 0 8 8 60 | 140 8 5 0 1in15 SD K1X No Yes Yes 0 8 175 30 (ML) | 140 8 5 0 1m15 SD K1X No Yes 0 8 175 30 075 1 | 140 8 5 0 11n15 SD K1X No Yes 0 8 175 30 0.75 1 | 145 8 4 11n10 11n10 SD K1X Yes Yes Yes 0 8 240 33 (MM) 8 | 145 8 4 1 m to 1 m to 8 Y m Y m 0 8 240 33 1/11 6 | 145 8 4 1 in 10 1 in 10 SD K1 X Yes Yes 0 8 240 33 111 (MU) 9 | 178 8 5 1 in 9 1 in 9 SD/K2 Kes Yes 0 8 285 36 1.375 | 178 8 5 1 in 9 1 h 9 SD,KZ KG Yes Yes 0 8 285 38 1.375 8 | 176 8 5 11in 9 11in 9 SD/K2 K2 Yes Yes Yes 0 8 2055 36 1375 8 | 107 8 4 11n10 11n10 SXX2 K2 Y68 Y68 Y68 0 8 150 30 (1.1.375 (MX) | 107 8 4 1in 10 1in 10 SD/R2 K2 Yes Yes Yes 0 8 150 38 1375 1 | 107 8 4 1 in 10 1 in 10 80.V2 K2 Yes Yes Yes 0 8 150 36 140 1 1 1 10 1 1 1 1 1 1 1 1 1 1 1 1 1 | 137 8 4 0 1in12 SD K1X No 9 197 30 0.75 8 | 137 8 4 0 11n12 SD K1X No Yes No 197 30 0.75 8 | 137 8 4 0 1 in 12 SD K1X No Yes 0 8 197 30 Q75 (ML) (ML) (ML) (ML) (ML) (ML) (ML) (ML) (ML) | 180 8 5 1m10 SDX K1X Yes Yes 0 8 10 (M) | 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes 0 8 180 30 10 100 5 1 in 10 50X K1X Yes Yes 0 8 180 30 (ML) | 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 190 30 1.0 (ML) |
| JACKET INFORMATION PILES INFORMATION | andidion Water Munnee Number Long, Trans, Long, Trans, Long, Trans, OverLap, Joint Pite Number Actual Pite Pite ^{Ma} word. Deph of Long Bays Bater Batter Batter Batter (BCXX/LS)(SCXX/LS)(Revise)(Network) pite Piter Piter Piter Piter More Deph of Long Bays Batter Batter (BCXX/LS)(SCXX/LS)(Revise)(Network) pite Piter Piter Piter Piter Piter Piter More Deph of Long Bays Batter Batter Piter | X00W 300 8 6 1 in 7.86 SDX K1 X2 Yes 4 8 320.940 48P. | N 343 8 6 8 9 8 8 9 8 9 8 9 9 9 9 9 9 9 9 9 9 | N 343 8 6 SDX X N0 8 8 | VGBV 247 8 5 5 50 K1X2 798 No 0 8 240 42 1375 | 4384 247 8 5 SD K1,K2 Yes No 0 8 240 42 1.375 . | VG6V 247 8 5 SD K1/X2 Ves No 0 8 240 42 1.375 1 | 108W 247 8 5 SD K1/K2 Yes No 0 8 240 42 1.375 1 | 125 8 3 SDX K2 No | 125 8 3 SDX K2 No | 125 8 3 SDX K2 N0 | 100V 340 8 4 11m10 11m10 SDXK3 SDXK3 (SK PR 8 8 190 48 1 1 m10 11m10 11m10 11m1 1 1 1 1 1 1 1 | 4 1 in 10 1 in 10 SDXK3 NO 8 8 10 10 10 10 10 10 10 10 10 10 10 10 10 | 4 1 in 10 1 in 10 20,K3 5D,X43 No 8 8 10 180 48 10 10 10 10 10 10 10 10 10 10 10 10 10 | NGE 310 8 5 11in8 11n8 SDX X NA Yes No 0 8 60 1 | NGE 310 8 5 11n8 11a SDX X NA Yes No 0 3 60 1 | NGE 310 8 5 1 In 8 1 n 8 5DX X NA Yes No 0 8 60 | V25V 140 8 5 0 1in15 SD K1X NO Yes 0 8 775 30 075 1 (ML) | V25V 140 8 5 0 1in15 SD K1X NO Yes 0 8 775 30 075 1 | V25V 140 8 5 0 11in 15 SD K1X No Yes Yes 0 8 175 30 0.75 1 (MU) | VISIV 145 8 4 11/110 11/11 SD VIX Yes Yes 0 8 240 33 11/1 8 | 4054V 145 8 4 1n10 1n10 SD K1X Yes Yes 0 8 240 33 111 K | 435W 145 8 4 1in10 1in10 SD K1X Yes Yes 0 8 8 240 33 111 (MU) 8 | 1.00 1.00 8 8 1.00 1.00 Ke | VOSV 178 8 5 110 110 80.42 Yes Yes Yes 0 8 285 38 1375 8 | 439V 178 8 5 11n9 11n9 SD/K2 K2 Yes Yes Yes 0 8 205 30 1375 4 | 107 8 4 1n10 1n10 SD/2 K2 K9 Yes Yes 0 8 15 2 K8 Yes 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 107 8 4 1 in 10 1 in 10 S30,K2 K2 Yes Yes Yes 0 8 150 38 1.375 1 (MU) | 107 8 4 in10 in10 SD.K2 K2 Yes Yes Yes 0 8 150 36 (301) | V15V 137 8 4 0 11n12 SD K1X No 198 No 0 8 197 30 0.75 8 | V15V 137 8 4 0 11n12 SD K1X No Yes No 0 8 197 30 075 8 | V15V 137 8 4 0 1 m12 SD K1X No Yes No 0 8 197 30 075 (ML) | V15V 180 8 5 1 m10 1 m10 SDX K1X Yes Yes Yes 0 8 8 3 10 30 10 | V15V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 MU | V15V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 1.0 (MU) |
| ON JACKET INFORMATION PILES INFORMATION | Oundation Mark Number Long, Trans, Long, Kanaber Lang, Kanaber Actuar Pate Pate Trans, Dorb of orLoga Bays Bater Bater Bater Bater (\$32XX1/2)(\$5XX1/2)(\$5X5000) (\$5060) | co N30V 300 8 6 1 m 7.96 1 m 7.96 SDX K1X2 Ye 4 8 20.340 42(S) | CO N 345 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | CO N 343 8 6 SDX X NO 8 8 | co NOBW 247 8 5 SD K1K2 Yes No 0 8 240 42 1375 · | co N36W 247 8 5 SD K1,K2 Yes No 0 8 240 42 1375 Yes | co NOBW 247 8 5 50 K1.K2 Ves No 0 8 240 42 1.375 1 | co N36W 247 8 5 SD K1/K2 Yes No 0 8 300 42 1375 1 | co 125 8 3 SDX K2 No | co 126 8 3 SDX N2 N0 | C0 125 8 3 SDX K2 N0 | co N30W 34D 8 4 1in 10 50,K3 SDXK3 10 (8M Pe 8 8 41 (8M Pe 9 (8M P | CO N30W 34D 8 4 1m10 1m10 SDX3 SDXX3 MO 8 8 180 48 | CO N30W 34D 8 4 1m10 1m10 SDX3 SDXX3 NO 8 8 180 48 | co NISE 310 8 5 1118 118 SDX X NA Yes No 0 8 60 | co N9E 310 8 5 1m8 1m8 2DX X NA Yes No 0 8 60 1 | co NISE 310 8 5 11n8 1n8 NA Yes No 0 8 60 | co N29V 140 8 5 0 1in15 SD K1X N0 Y6s Y6s 0 8 775 30 075 1 | col NZSW 140 8 5 0 1115 SD K1X No Yes 0 8 175 30 0.75 1 | co N23W 140 8 5 0 1in 15 SD K1X No Yes 0 8 175 30 0.75 1 | co N39W 145 8 4 1m10 1m10 SD K1X Yes Yes Yes 0 8 240 33 (MI) 8 | Co N33W 146 8 4 1110 SD K1X Yes Yes 0 8 240 33 111 6 | co NSBV 145 8 4 11110 11110 SD K1X Yes Yes Yes 0 8 240 33 1111 8 | Co N35W 178 8 5 1 in 9 1 in 9 SD, K2 K2 Yes Yes 0 8 265 36 1375 1 | Co NOSW 178 8 5 1 in 9 1 in 9 SO.X2 K2 Yes Yes 0 8 285 36 1.375 8 | co N39M 178 8 5 1 in 9 1 in 9 20,42 K2 Yes Yes Yes 0 8 205 38 137 4 | Col 107 8 4 1 in 10 1 in 10 SD,VC N2 Yes Yes 0 8 150 36 1.375 | Co 107 8 4 1 in 10 1 in 10 SD/R2 K2 Yes Yes 0 8 150 35 1.375 | co 107 8 4 1 in 10 1 in 10 SD, K2 K2 Yes Yes 0 8 150 36 13.75 1 | co NISM 157 8 4 0 1 m12 SD KIX NO Yes NO 0 8 197 30 0.75 8 | co NIBV 137 8 4 0 1in12 SD KIX No Yes No 0 8 197 30 075 8 | co NISW 137 8 4 0 1in12 SD K1X No Yes No 0 8 197 30 Q25 | Co N1SW 180 8 5 1 in 10 1 in 10 SD X K1 X Yes Yes 0 8 100 30 (M1) | co NIBV 180 8 5 1m10 1m10 SDX K1X Yes Yes 0 8 180 30 10 MU | 20 M15V 180 8 5 1 m10 1 m10 SDX K1X Yes Yes Yes 0 8 180 30 10 (ML) |
| MATION JACKET INFORMATION PILES INFORMATION | Orientation wave location for the location of | ref Mexico N30N 30D 8 6 1 in 7.96 1 in 7.96 SDX K1 X2 Yes 4 8 220.340 42(S) | Id Macico N 342 8 6 8DX X No 8 8 8 | rd Meetoo N 343 8 6 SDX X NO 8 8 | (d.Maeco NOBW 247 8 5 SO K1/K2 Yes No 0 8 240 42 1.375 | 1d Maecco NSBN 247 8 5 SD SD K1,K2 Yes No 0 8 240 42 1375 Y | rd Maeco N36W 247 8 5 S0 K1 K2 Yes No 0 8 240 42 1375 1 | rd Meeco N36W 247 8 5 SD K1/K2 Yes No 0 8 240 42 1.375 1 | 1d Maeico 125 8 3 SDX K2 No | rd Meeco 125 8 3 SDX K2 No | rd Meeico 125 8 3 SDX K2 No | 1d Meetoo NGOW 340 8 4 1 in 10 1 in 10 SD,K3 SD,X33 (SM: FB- 8 8 150 46 10 10 10 10 10 10 10 10 10 10 10 10 10 | Id Meeto N30V 340 8 4 1 in 10 1 in 10 SXX3 SDXX3 N0 8 8 8 180 48 | Icd Meetico NGOW 340 8 4 1 in 10 1 in 10 SD,K3 SD,X/3 NO 8 8 180 48 | raf Macico N19E 310 8 5 1 in 8 15 X X NA Y165 No 0 8 00 1 | Id Macico N19E 310 8 5 1 in 8 1 n 8 5 DX X NA Yes No 0 8 60 1 | Id Meeto NGE 310 8 5 1 in 8 1 h 8 SDX X NA Yes No 0 8 60 | 1d Maeco N29V 140 8 5 0 11n15 SD K1X No Yes 0 8 175 30 205 1 | (d.Maeco N29N 140 8 5 0 11n15 3D K1X No Yes Yes 0 8 775 3D 075 1 | rd Macco N28V 140 8 5 0 11in15 SD K1X No Yes 0 8 775 30 075 1 | rat Meetico N3SW 145 8 4 1 in 10 1 in 10 SD K1X Yes Yes Ye 0 8 240 23 111 6 (ML) 8 | 1d/Meeco N33W 146 8 4 11n10 11n10 820 K1X Yes Yes 0 8 20 33 111 8 (MU) | rd Meecico N33VV 145 8 4 1 in 10 1 in 10 SD K1,X Yes Yes Yes 0 8 240 23 1.11 9 | 1d Meeto N39V 178 8 5 1 In 9 1 19 SD/R2 K2 Yes Yes Yes 2 8 2 35 38 1 375 | (d.Maeco NSW 178 8 5 1119 119 SD/2 N2 N2 Yes Yes 0 8 205 205 205 1375 5 | 1d/Mexico N39V 178 8 5 11n9 11n9 SD/K2 K2 Yes Yes Yes 0 8 285 38 13.78 8 | 1d Maaco 107 8 4 1n 10 1n 10 20 X2 X2 Yas Yas Yas 0 8 150 8 75 35 1375 | 1d/Macco 107 8 4 1in10 1in10 SD/Z K2 Yas Yes Yes 0 8 150 36 1375 1 (MU) | 1d/Macco 107 8 4 1in 10 1in 10 SD,K2 K2 Yas Yas Yas 0 8 50 38 1375 1 | rad Meecko N1SW 157 8 4 0 11n12 SD K1X No Yee No 0 8 797 30 075 8 | rd Meeco N15W 15T 8 4 0 11h12 SD K1X No Yes No 0 8 197 30 075 8 | ref Meecico N15W 15T 8 4 0 11n12 SD K1X No Yes No 0 8 95 30 075 | 1d Meetool N1SV 189 8 5 1 m10 1 m10 SDX K1X Yes Yes Ye 0 8 8 780 30 (10) | rd Maecico N19V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes 0 8 10 20 10 (ML) | 'd/Macco N15W 18D 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 1.0 (MU) |
| INFORMATION JACKET INFORMATION PILES INFORMATION | Constration Vanter Number Long, Trans, Long, Lang, Trans, Long, Tra | 3 Gut d Maeco N30V 30D 8 6 1 in 7.86 1 in 7.86 SDX K1X2 Yes 4 8 200-340 48P | 8 Gutrat Muecco N 340 8 6 SDX X 00 8 8 | 8 Guid Meeto N 345 8 6 SDX X NO 8 8 | 9 Gurd Masco NGMV 247 8 5 SD K1/K2 Yes No 0 8 240 42 1375 | 9 Guird Meeco NOBW 247 8 5 SD K1/X2 Yes No 0 8 240 42 1375 . | 9 Guird Maaco N36N 247 8 5 S SS K1,K2 Yes No 0 8 240 42 1375 1 | 9 Guird Meetico NOBW 247 8 5 SO K1/X2 Yes No 0 8 240 42 1375 1 | 9 Gufd Macco 128 8 3 SDX K2 No | 9 Guira Maecco 125 8 3 SDX K2 No | 9 Guird Meeico 128 8 3 SDX K2 No | 7 Guird Meetico NOOW 340 8 4 1 in 10 1 in 10 SD/X SDX/X3 (Star Pte 8 8 190 48 1 | 7 Guild Meetico NDOV 340 8 4 1 m 10 1 m 10 20,X3 SDX,X3 No 8 8 8 180 48 | 7 Guild Meetico NDOV 340 8 4 1 in 10 1 in 10 SDX/S SDX/S NO 8 8 8 180 48 | Gutrat Meetico N19E 310 8 5 1 n 8 1 n 8 SDX X NA Yes No 0 8 00 1 | Guird Meetoo N19E 310 8 5 1n8 1n8 5DX X NA Yes No 0 8 0 0 | Cutrid Meetico NISE 310 8 5 1 m8 1 m8 SDX X NA Yes No 0 8 60 | 7 Guird Maaco N29V 140 8 5 0 1 in 15 30 K/X No Yes Ve 0 8 775 30 (ML) | 7 Gurd Meeco N2BW 140 8 5 0 1m15 SD K1X No Ves Ves 0 8 75 30 075 1 MU | 7 Guird Meeted N2SW 140 8 5 0 1 in 15 SD K1X No Yes Yes 0 8 775 20 0.1 M 1 | 2 Guird Meeco NSW 145 8 4 1 in 10 1 in 10 SD KLX Yes Yes 0 8 2 00 3 111 1 | 2 Gurd Macco NS9W 145 8 4 1 in 10 1 in 10 SD K1X Yes Yes Ye 0 8 20 33 111 8 (MU) | 2 Guird Meeco NSDN 145 8 4 1 m 10 1 m 10 8D K1X Yes Yes 0 8 240 30 1.11 8 | 9 Gurd Maxico NGSW 178 8 5 1 in 9 1 n 9 SD/X2 N2 Yes Yes Yes 0 8 265 36 1.375 | 9 Guid Macco NOSM 178 8 5 1 in 9 1 n 9 SD/C NC NO Yes Yes 0 8 265 36 1 375 5 | 9 Guird Meetco N39W 178 8 5 1 in 9 1 in 9 20,K2 K2 Yes Yes Yes 0 8 28.5 36 1 375 8 | 7 Guid Massico 107 8 4 1 in 10 83,42 K2 Y2 | 7 Gurd Meeco 107 8 4 1 in 10 1 101 83 72 12 Yes Yes Yes 0 8 150 38 1375 1 101 | 7 Guird Meeted 107 8 4 1 in 10 1 in 10 SD/R2 K2 K2 Yes Yes 0 8 150 38 157 1: (ML) | 1 Guird Meeto NISM 137 8 4 0 1 in 12 SD KIX No Yes No 0 8 197 30 075 8 | 1 Guird Meeco NISV 137 8 4 0 1in 12 SD K1X No Yes No 0 8 197 30 075 8 | 1 Guird Maecico NISV 137 8 4 0 1 in 12 SD KIX No Yes No 0 8 197 30 075 | 3 Gurd Meecko N1SM 150 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Ye 0 8 8 190 20 (01) | 3 Guild Maaco NISW 180 8 5 1 m 10 1 m 10 SDX KIX Yes Yes 0 8 10 30 10 Mu | 3 Guird Meeco N19V 180 8 5 1 in 10 1 in 10 SDX K1X Ves Yes 0 8 190 20 20 10 MU |
| 2RM INFORMATION JACKET INFORMATION PILES INFORMATION | Visur location Water Montholm (New Montholm Variant, Long, Trans, Long, | 1973 Guird Meeco N30V 330 8 6 1 n 7.86 SDX K1 X2 Yes 4 8 305-30 42S | 1978 Gulf Miesco N 343 8 6 SDX X No 8 8 | 1978 Guild Maeco N 343 8 6 SDX X No 8 8 | 1989 Culif Maxico NDM 247 8 5 30 42 1375 - | 1989 Guird Nuesco NOBW 247 8 5 SD K1 X2 Yes No 0 8 240 42 1375 7 | 1969 Out of Masco NOBV 2rf 8 5 SO K1X2 Yts No 0 8 240 42 1375 1 | 1969 Guild Meetico N1964 247 8 5 5 50 K1 X2 Yes No 0 8 240 42 1375 1 | : 1979 Guird Meeto 125 8 3 SDX K2 No | : 1379 Guird Moucho | : 1979 Guild Meetco 125 8 3 SDX K2 No | 1967 Outric Meetics N300 340 34 1in 10 SD/X K3 SD/X K3 SD/X K3 1 (SM PS- Y cs) 8 8 1 (SM PS- Y cs) 1 (SM PS- Y cs) 8 1 (SM PS- Y cs) 1 | 1967 Guild Meeto NOW 340 8 4 1 in 10 1 in 10 80,X3 SDX/X3 No 8 8 180 48 1 | 1957 Outlid Meeto N30M 34D 8 4 1 m to SD/X SD/X Mo 8 8 180 48 1 100 20/X 20/X 20/X 100 8 8 100 48 1 100 100 20/X 20/X 20/X 8 8 100 48 100 100 48 100 48 100 48 100 48 100 48 100 48 100 100 48 <t< th=""><th>Ould Meeto NI9E 310 8 5 1 in 8 5DX X NA Yes No 0 8 00 1</th><th>OutforMeetics NISE 310 8 5 1 In 8 2 0 0 8 60 1 <th1< th=""> <th1< t<="" th=""><th>Outfort Meetico NISE 310 8 5 1 In 8 1 h.8 SDX X NA Yes No 0 8 60</th><th>1957 Guird Maaco N29V 142 8 5 0 1 1 in 15 SD K1X No Yrs V 8 0 8 175 30 (235 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</th><th>1957 Guild Meeco N28V 140 8 5 0 1115 SD K1X No Yes 0 8 75 30 (015 1</th><th>1957 Guird Macecia N2SW 140 8 5 0 1115 SD K1X No Yes 0 8 175 30 0.75 1</th><th>1942 Guird Maaco N39V 145 8 4 1 in 10 1 in 10 SS K1X Yes Yes Yes 0 8 240 30 31 11 (ML) 8</th><th>1982 Guird Mecico NGM 145 8 4 1 in 10 SD K1 X Yes Yes 0 8 20 33 111 5</th><th>1982 Sulf of Mexico N3SV 145 8 4 1 in 10 1 in 10 SD K1 X Yes Yes 0 8 240 33 1.11 9</th><th>1969 Guff Missico NGW 178 8 5 1 ing 1 ng 20,42 K2 Yes Yes Yes 0 8 265 36 1.375</th><th>1989 Outld Macco NOSV 178 8 5 1 in 9 SD/2 NC Yes Yes 0 8 265 36 1 375 5</th><th>1969 Guid Maacio N39V 178 8 5 11n9 119 SD/2 K2 Yes Yes Ye 0 8 285 36 1375 8</th><th>1957 Guild Masco 107 8 4 1 m 10 SD/R2 K2 Ves Ves 0 8 50 26 7.375</th><th>1987 Guild Miesco 107 8 4 1 in 10 1 in 10 83,V2 K2 Ves Ves Ves 0 8 150 38 1375 1 MK2 1 MK2</th><th>1967 Out/d Meeto 107 8 4 1 m to SD/K2 K2 Ves Yes 0 8 150 36 1.375 15</th><th>1961 Out of Mexico NISV 157 8 4 0 1 m12 SD K1X No Yes No 8 197 30 075 8</th><th>1961 Out of Mexico NISV 157 8 4 0 11n12 SD K1X No No 0 8 197 30 075 8</th><th>1961 Out of Macco NSV 137 8 4 0 1m12 SD K1X No Yes A 30 0.75 1981 Out of Macco NSV 137 8 4 0 1m12 SD K1X No Yes 8 197 30 0.75</th><th>1963 Cull'AlMacico NISM 180 6 1 in 10 SDX K1X Yes Yes 0 8 100 30 100</th><th>(193 Out of Meetics N15W 180 8 5 1 in 10 5DX K1X Yes Yes 0 8 180 30 10 (193 Out of Meetics N15W 18 X X1X Yes Yes 0 8 180 30 (M1)</th><th>1963 Guird Maxico N1SV 180 8 5 1 m10 1 m10 SDX K1X Yes Yes Yes 0 8 180 30 10 (MU)</th></th1<></th1<></th></t<> | Ould Meeto NI9E 310 8 5 1 in 8 5DX X NA Yes No 0 8 00 1 | OutforMeetics NISE 310 8 5 1 In 8 2 0 0 8 60 1 <th1< th=""> <th1< t<="" th=""><th>Outfort Meetico NISE 310 8 5 1 In 8 1 h.8 SDX X NA Yes No 0 8 60</th><th>1957 Guird Maaco N29V 142 8 5 0 1 1 in 15 SD K1X No Yrs V 8 0 8 175 30 (235 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</th><th>1957 Guild Meeco N28V 140 8 5 0 1115 SD K1X No Yes 0 8 75 30 (015 1</th><th>1957 Guird Macecia N2SW 140 8 5 0 1115 SD K1X No Yes 0 8 175 30 0.75 1</th><th>1942 Guird Maaco N39V 145 8 4 1 in 10 1 in 10 SS K1X Yes Yes Yes 0 8 240 30 31 11 (ML) 8</th><th>1982 Guird Mecico NGM 145 8 4 1 in 10 SD K1 X Yes Yes 0 8 20 33 111 5</th><th>1982 Sulf of Mexico N3SV 145 8 4 1 in 10 1 in 10 SD K1 X Yes Yes 0 8 240 33 1.11 9</th><th>1969 Guff Missico NGW 178 8 5 1 ing 1 ng 20,42 K2 Yes Yes Yes 0 8 265 36 1.375</th><th>1989 Outld Macco NOSV 178 8 5 1 in 9 SD/2 NC Yes Yes 0 8 265 36 1 375 5</th><th>1969 Guid Maacio N39V 178 8 5 11n9 119 SD/2 K2 Yes Yes Ye 0 8 285 36 1375 8</th><th>1957 Guild Masco 107 8 4 1 m 10 SD/R2 K2 Ves Ves 0 8 50 26 7.375</th><th>1987 Guild Miesco 107 8 4 1 in 10 1 in 10 83,V2 K2 Ves Ves Ves 0 8 150 38 1375 1 MK2 1 MK2</th><th>1967 Out/d Meeto 107 8 4 1 m to SD/K2 K2 Ves Yes 0 8 150 36 1.375 15</th><th>1961 Out of Mexico NISV 157 8 4 0 1 m12 SD K1X No Yes No 8 197 30 075 8</th><th>1961 Out of Mexico NISV 157 8 4 0 11n12 SD K1X No No 0 8 197 30 075 8</th><th>1961 Out of Macco NSV 137 8 4 0 1m12 SD K1X No Yes A 30 0.75 1981 Out of Macco NSV 137 8 4 0 1m12 SD K1X No Yes 8 197 30 0.75</th><th>1963 Cull'AlMacico NISM 180 6 1 in 10 SDX K1X Yes Yes 0 8 100 30 100</th><th>(193 Out of Meetics N15W 180 8 5 1 in 10 5DX K1X Yes Yes 0 8 180 30 10 (193 Out of Meetics N15W 18 X X1X Yes Yes 0 8 180 30 (M1)</th><th>1963 Guird Maxico N1SV 180 8 5 1 m10 1 m10 SDX K1X Yes Yes Yes 0 8 180 30 10 (MU)</th></th1<></th1<> | Outfort Meetico NISE 310 8 5 1 In 8 1 h.8 SDX X NA Yes No 0 8 60 | 1957 Guird Maaco N29V 142 8 5 0 1 1 in 15 SD K1X No Yrs V 8 0 8 175 30 (235 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1957 Guild Meeco N28V 140 8 5 0 1115 SD K1X No Yes 0 8 75 30 (015 1 | 1957 Guird Macecia N2SW 140 8 5 0 1115 SD K1X No Yes 0 8 175 30 0.75 1 | 1942 Guird Maaco N39V 145 8 4 1 in 10 1 in 10 SS K1X Yes Yes Yes 0 8 240 30 31 11 (ML) 8 | 1982 Guird Mecico NGM 145 8 4 1 in 10 SD K1 X Yes Yes 0 8 20 33 111 5 | 1982 Sulf of Mexico N3SV 145 8 4 1 in 10 1 in 10 SD K1 X Yes Yes 0 8 240 33 1.11 9 | 1969 Guff Missico NGW 178 8 5 1 ing 1 ng 20,42 K2 Yes Yes Yes 0 8 265 36 1.375 | 1989 Outld Macco NOSV 178 8 5 1 in 9 SD/2 NC Yes Yes 0 8 265 36 1 375 5 | 1969 Guid Maacio N39V 178 8 5 11n9 119 SD/2 K2 Yes Yes Ye 0 8 285 36 1375 8 | 1957 Guild Masco 107 8 4 1 m 10 SD/R2 K2 Ves Ves 0 8 50 26 7.375 | 1987 Guild Miesco 107 8 4 1 in 10 1 in 10 83,V2 K2 Ves Ves Ves 0 8 150 38 1375 1 MK2 | 1967 Out/d Meeto 107 8 4 1 m to SD/K2 K2 Ves Yes 0 8 150 36 1.375 15 | 1961 Out of Mexico NISV 157 8 4 0 1 m12 SD K1X No Yes No 8 197 30 075 8 | 1961 Out of Mexico NISV 157 8 4 0 11n12 SD K1X No No 0 8 197 30 075 8 | 1961 Out of Macco NSV 137 8 4 0 1m12 SD K1X No Yes A 30 0.75 1981 Out of Macco NSV 137 8 4 0 1m12 SD K1X No Yes 8 197 30 0.75 | 1963 Cull'AlMacico NISM 180 6 1 in 10 SDX K1X Yes Yes 0 8 100 30 100 | (193 Out of Meetics N15W 180 8 5 1 in 10 5DX K1X Yes Yes 0 8 180 30 10 (193 Out of Meetics N15W 18 X X1X Yes Yes 0 8 180 30 (M1) | 1963 Guird Maxico N1SV 180 8 5 1 m10 1 m10 SDX K1X Yes Yes Yes 0 8 180 30 10 (MU) |
| LATFORM INFORMATION JACKET INFORMATION PILES INFORMATION | Vert Lottion Device Lottion True Norm Device Base Base Base Parts Long. Trans. Long. Trans. Long. Trans. Long. Long. Long. Trans. Long. Trans. Long. L | SACS 1973 Out of Meetics NOW 300 8 6 1 in 7 88 SD X K1 X2 Yes 4 8 20 340 48P | 1978 Guild Meetoo N 340 8 6 SDX X 00 8 8 | 1978 Out of Macco N 343 8 6 SDX X No 8 8 | 1999 Out of Meeco NOBY 247 8 5 SD K1 X2 Yes No 0 8 240 42 1375 | 1869 Gut d Meeteo NGW 247 8 5 SD K1 K2 Yes No 0 8 240 42 1.375 1 | 1969 Our diversion N30W 247 8 5 SD X1X2 Yes No 0 8 240 42 1375 1 | 1969 Out of Maccio N38W 247 8 5 SD K1 /K2 Yes No 0 8 240 42 1375 1 | SVEAUC 1973 Guid Monico 125 8 3 SDX K2 No | SkE.MC 1979 Guild Meetic 125 8 3 SDX K2 N0 N0 | SNEARC 1879 Out of Meeto 125 8 3 SDX K2 No | CuP 1987 Curier Meetics N30W 340 8 4 1 in 10 1 in 10 SD,XG SDXX3 (Str. Ph. 8 8 130 48) 4 1 in 10 1 in 10 SD,XG SDXX3 (Str. Ph. 8 8 130 48) 48 1 | C4P 1987 Out of Matcia N30W 34D 8 4 1 in 10 1 in 10 SD,X3 SDXX3 No 8 8 130 48 1 | CAP 1967 Cuird Meeco N30W 340 8 4 1 in 10 1 in 10 SD/X3 SDXX3 No 8 8 180 48 1 | Outof Meetico NUSE 310 8 5 1 in 8 1 in 8 SDX X NA Yes No 0 8 60 1 1 1 1 1 1 1 8 NA Yes No 0 8 60 1 <th1< th=""> 1 1 <th1< th=""></th1<></th1<> | Outof Meeco NSE 310 8 5 1 in 8 1 h 8 SDX X NA Yes No 0 8 8 50 1 | Outlot Meetice 310 8 5 1 in 8 1 h 8 SDX X NA Yes No 0 8 80 1 < | SACS 1957 Out-differed N29V 140 8 5 0 1 in 15 SD K1X No Yes 0 8 775 30 (ML) | SetCs 1877 Guild Meeto NZSW 140 8 5 0 1 in 15 SD K1 X No Yes 0 8 75 30 202 1 m | SACS 1957 Guid Meetico N28M 140 8 5 0 1m15 SD K1X No Yes 0 8 175 30 0.75 | SACS 1822 Out of Meetics N33W 145 8 1 <th>Success 1982 Guild Meaco NOSM 145 8 4 1 In 10 SD K1 X Yes Yes 0 8 200 33 111 5</th> <th>SACS 1962 Gut d'Merco N39W 145 8 4 11n10 11n10 SD K1X Yes Yes Ye 0 8 240 33 111 8</th> <th>Secs 1889 Ould Meeco NSW 178 8 1 119 80,12 Vo. Vo. 9 26 20 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 <</th> <th>SALCS 1898 Out of Masco NOW 178 8 119 ED SOLZ K2 Yes Yes 0 8 285 28 1.375 8</th> <th>SACS 1969 Gut/at Mexico N39V 178 8 5 1 in 9 1 in 9 SD/R2 K2 Yes Yes 0 8 285 36 1 375 8</th> <th>SetCs 187 Out of Meeco 107 8 4 1 in 10 1 in 10 201/2 Yes Yes 0 8 Yes Yes</th> <th>SACS 1987 Out of Meetics 107 8 4 1 in 10 SD/R2 K2 Ves Ves 0 8 150 38 1.375</th> <th>SACS 1987 Gut of Mexico 107 8 4 1 in 10 SD/2 K2 Ves Yes 0 8 150 36 1.375 11</th> <th>SALS 1961 Cuird Meetol NISW 137 8 4 0 1 in 12 SD K1 X No Yes No 8 137 30 Q75 8</th> <th>SACS 1961 Cuird Meecia NISW 137 8 4 0 1 in 12 SD KI X No Yes No 8 197 30 0.75 8</th> <th>SACS 1961 Guird Meeco MSW 137 8 4 0 1 In 12 SD N1X No Yes No 8 197 30 0.01</th> <th>SetCs 1803 Cuild MeetCo N1SH 1803 Set Yes Yes Yes 0 80 30 30 10</th> <th>SACS 1963 Gut d Macico NISW 180 8 1 in 10 1 in 10 SDX KI X Yes Yes 0 8 160 30 10</th> <th>SACS 1983 Guid Meeco N19W 130 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 (ML)</th> | Success 1982 Guild Meaco NOSM 145 8 4 1 In 10 SD K1 X Yes Yes 0 8 200 33 111 5 | SACS 1962 Gut d'Merco N39W 145 8 4 11n10 11n10 SD K1X Yes Yes Ye 0 8 240 33 111 8 | Secs 1889 Ould Meeco NSW 178 8 1 119 80,12 Vo. Vo. 9 26 20 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 1 1 375 < | SALCS 1898 Out of Masco NOW 178 8 119 ED SOLZ K2 Yes Yes 0 8 285 28 1.375 8 | SACS 1969 Gut/at Mexico N39V 178 8 5 1 in 9 1 in 9 SD/R2 K2 Yes Yes 0 8 285 36 1 375 8 | SetCs 187 Out of Meeco 107 8 4 1 in 10 1 in 10 201/2 Yes Yes 0 8 Yes | SACS 1987 Out of Meetics 107 8 4 1 in 10 SD/R2 K2 Ves Ves 0 8 150 38 1.375 | SACS 1987 Gut of Mexico 107 8 4 1 in 10 SD/2 K2 Ves Yes 0 8 150 36 1.375 11 | SALS 1961 Cuird Meetol NISW 137 8 4 0 1 in 12 SD K1 X No Yes No 8 137 30 Q75 8 | SACS 1961 Cuird Meecia NISW 137 8 4 0 1 in 12 SD KI X No Yes No 8 197 30 0.75 8 | SACS 1961 Guird Meeco MSW 137 8 4 0 1 In 12 SD N1X No Yes No 8 197 30 0.01 | SetCs 1803 Cuild MeetCo N1SH 1803 Set Yes Yes Yes 0 80 30 30 10 | SACS 1963 Gut d Macico NISW 180 8 1 in 10 1 in 10 SDX KI X Yes Yes 0 8 160 30 10 | SACS 1983 Guid Meeco N19W 130 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 10 (ML) |
| PLATFORM INFORMATION JACKET INFORMATION PILES INFORMATION | Our software installed to catter any two parts and the software installed to the software instal | W-12 SACS 1973 Guid Meeto N30V 33D 8 6 1 in 7.86 1n 7.86 SDX K1X2 Yes 4 8 20.340 48P 42S | VF-01 1978 Guild Meeted N 340 8 6 SDX X M 99 8 8 8 | VF-02 1978 Out of Marcio N 343 8 6 SDX X Mo 8 8 | VF-01 1888 Out of Meetics NORV 2x7 8 No 0 8 240 42 1375 - | WF-02 1969 Guff d Mexico NGBV 2d7 8 5 SD K1,K2 Yes No 0 8 240 42 1375 · | VF30 1969 Out of Mexica 247 8 5 30 Ki X2 Yes No 0 8 30 42 1375 1 | VF-04 1969 Guild Mueicla NOBY 247 8 5 20 Ki/X2 Yes No 0 8 240 42 1375 1 | VF-01 SNE-MC 1979 GUITERMODED 125 8 3 SDX N2 | WF22 SVF.MC 1979 Guild Meetod 125 8 3 SDX K2 No | VF-03 SVF-MC 1979 Guild Meetico 125 8 3 SDX K2 No | VF-01 CLP 1967 Gut d Mexico NOOW 340 8 4 1 in 10 50,X3 50,XX 10 18 4 8 1 in 10 1 10 1 10 1 10 1 10 1 10 1 10 1 | F-02 CAP 1967 Guid Mexico NOOM 340 8 4 1 In 10 1 In 10 SO/X3 SOXX3 No 8 8 4 1 In 10 1 In 10 SO/X3 SOXX3 No 8 8 80 480 48 | VF33 CAP 1967 Guid Meeco NOOW 340 8 4 1 in 10 1 in 10 SD/X3 SDXX3 No 8 8 190 48 | VF-01 Guid Meeco N19E 310 8 5 1in 8 1n 8 SDX X MA Yes No 0 8 60 1 | WF-02 Guid Mexico NI9E 310 8 5 1 in 8 1 h 8 SDX X NA Yes No 0 8 80 10 | VF33 Out of Moreco NIGE 310 8 5 1 m8 1 m8 SDX X NA Yes No 0 8 00 10 | VF01 SACS 1957 Gut d Mexico V29 140 8 5 0 1 in 15 SD K1 X No Yes 0 8 75 30 (M2) 1 | WFace SACS 1857 Guid diverce N28V 140 8 5 0 1 h15 SD KIX No Yes 0 8 75 30 (33) 1 | VF-00 8ACS 1957 Guild Macco N25W 140 8 5 0 1 in 15 8D K1X No Yes Yes 0 8 775 30 075 1 | WF01 SACS 1982 Cult of Mexico NSM 146 8 4 1 in 10 SD K1 X Yes Yes 0 8 240 23 111 5 | WFace SACS 1982 Guild Heaco NSSW 145 8 111 SS NX Yes Yes 20 3 211 21 | VF-03 SACS 1962 Guild Meeco ND3W 145 8 4 1 in 10 1 in 10 SD K1X Yes Yes Yes 0 8 240 33 1.11 8 | NFOI SACS 1989 Out of Meetics NOSH 178 8 5 1 m 9 SOL(2) Yes Yes Yes 0 8 265 205 1.375 1 1.375 1 1.375 1 1.375 1 <th>Wrace SACS 1899 Guid Meeco NOS 178 8 1<th>VF-03 SACS 1969 Guild Mexico NOSV 178 8 5 1 in 9 1 h 9 SD,K2 K2 Y6s Y6s Y6s 0 8 285 39 1 375 1</th><th>WF01 SACS 1987 Out of Meeted 107 8 110 13.02 No 13.05 No No 13.05 No 13.05 No</th><th>VF-02 SACS 1987 Guild Nexco 107 8 4 11n10 11n10 SD/32 K2 V4s V4s V4s 0 8 150 35 1375 1</th><th>VF-00 8ACS 1987 Guild Maxico 107 8 4 1in 10 1in 10 80.V2 K2 K5 Yes Yes 0 8 150 8 150 36 1.375 11</th><th>WF01 SACS 1961 Galf of Meetico N157 8 4 0 11n12 SD K1 X No Yes No 8 137 30 Q75 8</th><th>VF-22 SACS 1961 Guid-Meecia NISM 137 8 4 0 11n12 SD K1X No Yes No 0 8 197 20 075 8 (MJ)</th><th>W-33 SACS 1661 Guid Meeted NISV 157 8 4 0 1 in 12 SD NIX No Yee No 0 8 197 30 (NU)</th><th>VF01 SACS 1863 Out of Meetics N150 8 1 mode 1 mode 1 mode 10 20 10 20 10 VF01 Immode Immode</th><th>VF-02 8ACS 1963 Gutd Maecko N19V 180 8 5 1 in 10 1 in 10 8DX K1X Yes Yes 0 8 80 30 400</th><th>W-32 BACS 1963 Cufreed Meetico N19V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 190 20 20 (ML)</th></th> | Wrace SACS 1899 Guid Meeco NOS 178 8 1 <th>VF-03 SACS 1969 Guild Mexico NOSV 178 8 5 1 in 9 1 h 9 SD,K2 K2 Y6s Y6s Y6s 0 8 285 39 1 375 1</th> <th>WF01 SACS 1987 Out of Meeted 107 8 110 13.02 No 13.05 No No 13.05 No 13.05 No</th> <th>VF-02 SACS 1987 Guild Nexco 107 8 4 11n10 11n10 SD/32 K2 V4s V4s V4s 0 8 150 35 1375 1</th> <th>VF-00 8ACS 1987 Guild Maxico 107 8 4 1in 10 1in 10 80.V2 K2 K5 Yes Yes 0 8 150 8 150 36 1.375 11</th> <th>WF01 SACS 1961 Galf of Meetico N157 8 4 0 11n12 SD K1 X No Yes No 8 137 30 Q75 8</th> <th>VF-22 SACS 1961 Guid-Meecia NISM 137 8 4 0 11n12 SD K1X No Yes No 0 8 197 20 075 8 (MJ)</th> <th>W-33 SACS 1661 Guid Meeted NISV 157 8 4 0 1 in 12 SD NIX No Yee No 0 8 197 30 (NU)</th> <th>VF01 SACS 1863 Out of Meetics N150 8 1 mode 1 mode 1 mode 10 20 10 20 10 VF01 Immode Immode</th> <th>VF-02 8ACS 1963 Gutd Maecko N19V 180 8 5 1 in 10 1 in 10 8DX K1X Yes Yes 0 8 80 30 400</th> <th>W-32 BACS 1963 Cufreed Meetico N19V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 190 20 20 (ML)</th> | VF-03 SACS 1969 Guild Mexico NOSV 178 8 5 1 in 9 1 h 9 SD,K2 K2 Y6s Y6s Y6s 0 8 285 39 1 375 1 | WF01 SACS 1987 Out of Meeted 107 8 110 13.02 No 13.05 No No 13.05 No 13.05 No | VF-02 SACS 1987 Guild Nexco 107 8 4 11n10 11n10 SD/32 K2 V4s V4s V4s 0 8 150 35 1375 1 | VF-00 8ACS 1987 Guild Maxico 107 8 4 1in 10 1in 10 80.V2 K2 K5 Yes Yes 0 8 150 8 150 36 1.375 11 | WF01 SACS 1961 Galf of Meetico N157 8 4 0 11n12 SD K1 X No Yes No 8 137 30 Q75 8 | VF-22 SACS 1961 Guid-Meecia NISM 137 8 4 0 11n12 SD K1X No Yes No 0 8 197 20 075 8 (MJ) | W-33 SACS 1661 Guid Meeted NISV 157 8 4 0 1 in 12 SD NIX No Yee No 0 8 197 30 (NU) | VF01 SACS 1863 Out of Meetics N150 8 1 mode 1 mode 1 mode 10 20 10 20 10 VF01 Immode Immode | VF-02 8ACS 1963 Gutd Maecko N19V 180 8 5 1 in 10 1 in 10 8DX K1X Yes Yes 0 8 80 30 400 | W-32 BACS 1963 Cufreed Meetico N19V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 190 20 20 (ML) |
| PLATFORM INFORMATION JACKET INFORMATION PILES INFORMATION | Parab-Owr Setware Installed Location Transient Mumber Number Setware Number Number Number Number Number Actual Plan Plan Plan Plan Plan Plan Plan Pl | P12NF12 SACS 1973 Guid Matcia N30W 300 8 6 1 in 736 1 in 756 SDX K1X2 Yes 4 8 203-340 43P 42S | P15/NF-01 1978 Guid Meeco N 340 8 6 SDX X M 0 8 8 | P15NF-02 1978 Guild Meeco N 343 8 6 SDX X N 0 8 8 | P18-NF-01 1969 Out-d-Matco N30V 247 8 5 5 50 K1/2 Yes No 0 8 240 42 1375 | P18-NF-22 1999 Guid Macco NGM 247 8 5 5 50 K1/K2 Yes No 0 8 240 42 1375 7 | P18.NE-03 1969 Guid Macco N39N 247 8 5 S0 K1/X2 Y68 N0 0 8 240 42 1375 1 | P18.NE-04 1969 Guid Macco N36M 247 8 5 20 XX X2 N6 0 8 20 42 1.375 1 | P194PE/11 SHE4AC 1979 Gutfet Mexico 125 8 3 SDX 122 No | P184F22 S4F44C 1979 Guid Meeco 125 8 3 SDX K2 No | P19-NF-03 SKEMC 1979 Guid Meeco 125 8 3 SDX K2 No | P244PE-01 CAP 1967 Cutrit Moscio NGOW 340 8 4 1 in 10 1 in 10 SO/X3 SO/X43 (SM PR- Yes) Yes) 8 8 100 48 10 10 10 10 10 10 10 10 10 10 10 10 10 | P248F42 CAP 1967 Guid Macto N30W 340 8 4 11m10 1m10 50,K3 50,X3 Mo 8 8 8 8 180 48 | P244PC0 CAP 1967 Curid Maxico NOOM 340 8 4 1 m 10 1 m 10 20,K3 SDXK3 No 8 8 40 480 48 | P27xNE-01 Guid Maecco NI9E 310 8 5 1n8 1n8 SDX X NA Yes No 0 8 60 1 | P27xH522 Guid Macco NVBE 310 8 5 1 in 8 15 3 1 in 8 50 X X NA Yas No 0 8 6 60 1 | P27AF430 Guid Meeco NISE 310 8 5 1 in 8 1n 8 SDX X MA Yes No 0 8 00 | P284F51 84C5 1957 Guid Macco N29V 140 8 5 0 1n15 SD K1X No Yes Yes 0 8 175 30 015 10 101 | P28AF-02 8ACS 957 Guid Meeco N29V 140 8 5 0 1 h15 SD K1X NO Y8 Y8 0 8 75 0 8 775 30 (M3 1 | P28APE-00 SACS 1957 GuiferMeecico N28M 140 8 5 0 1 in 15 SD K1X No Yes 0 8 775 20 205 1 MU | P33NF01 84CS 982 Guid/Mecco N39V 145 8 4 111/0 11/1 0 20 K1X Yes Yes Ye 0 8 20 20 (31) 1 | P33NF42 SACS 1982 Guid Meeco N38W 145 8 4 1m10 1m10 SD K1X Y4s Y4s Ye 0 8 240 23 (111 R (N) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | P33NF-00 SACS 1982 Guild Meeco N39N 146 8 4 1 in 10 1 in 10 80 K1X Yes Yes 0 8 240 8 23 111 8 | P344F51 8ACS 1969 Guid Macto N39V 178 8 5 1 in 9 1n 9 80,k2 K2 Y68 Y68 Y68 0 8 285 26 1375 1 | P34AF42 SACS 1989 Guid Neeco N39V 178 8 5 1n9 1n9 20,22 K2 Y4s Y4s Y4s 0 8 2 35 2 135 1 135 1 | P34-NF-03 SACS 1989 Guild Nexceo N39N 178 8 5 1189 119 119 8 SD/2 K2 K2 Yes Yes Yes 0 8 285 38 1375 1 | P13-NF-01 5ACS 1967 0utrd/Match | P37NFr2 SACS 1987 Guid Meeto 107 8 4 111/0 SUC2 XX 745 Yes Yes 0 8 16 0 3 150 25 1375 1 | P17-NE-00 SACS 1967 Guid Macco 107 8 1 + 1 in 10 1 in 10 1 in 10 SD, R2 K2 K5 Yes 0 8 150 30 1375 1: | P38AF571 SACS 1961 Gutd-Mesco N15V 137 8 4 0 1 In12 SD K1X No Yes No 0 8 197 30 035 8 (ML) | P38AF22 8AC3 991 Guid Macco NISV 177 8 4 0 1n12 SD KIX No Yes No 0 8 797 30 035 6 (ML) | P38AF43 8AC3 991 Guid Macio NISM 137 8 4 0 1112 SD KIX No Yes No 0 8 937 30 043 | P40APE01 SACS 953 Out-d Macco N1SM 150 8 5 1 in 10 1 In 10 SDX M1X Yes Yes Yes 0 8 78 30 10 10 10 10 10 10 10 10 10 10 10 10 10 | P40-NF-02 SACS 1983 Guifel Maxico N1SN 180 8 5 1m10 1m10 SDX K1X Yes Yes 0 8 180 30 (40) | P405NE-03 SACS 1963 Guird Mascio N15W 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 180 30 (10 (ML) |
| PLATFORM INFORMATION JACKET INFORMATION PILES INFORMATION | Particime Para-Over Stefeware instantiation for the part of the pa | P12 P12.NF-22 5xC5 1973 Gufd Macco N30V 300 8 6 1 in 7.86 1 in 7.86 SDX N1X2 Yes 4 8 20.30 43P 43S | PIS PISAR-01 1978 Gut d Maxico N 343 8 6 SDX X M 00 8 8 | Pris Priswerd2 1978 Guid Meeco N 340 8 6 SDX X Mo 8 8 | P18 P16.4F-01 7698 Gut/d146620 ND8V 247 8 5 5 50 K1/K2 Y68 N0 0 8 240 42 1375 | P18 P18MF-02 1989 Guild Meeco N36V 247 8 5 5 50 K1 K2 Yea No 0 8 240 42 1375 - | P18 P16-WF-03 T669 Gufd Meeco NOBM 247 8 5 5 50 K1 X2 Yes No 0 8 240 42 1375 1 | P18 P16-WF-04 1669 Gutd Macco NDB/V 247 8 5 50 K1/X2 169 ND 0 8 240 42 1.375 1 | P19 P19.4E-01 B4E.MC 1979 Guif Mission 125 8 3 SDX 12 No | P19 P164F422 S4E4AC 1978 Gut d Mexco | P19 P19.4K-00 SAF.3AC 1573 Gut d Mexico 125 8 3 3 SDX K2 No | P34 P24-W5-01 CAP 1967 Gutd Musico N30V 340 8 4 1 in 10 1 in 10 50,K3 50,K3 10 (54K Pb- 8 8 150 46 14 16 16 16 16 16 16 16 16 16 16 16 16 16 | P34 P246*22 CAP 1967 Gutd Macco N304 340 8 4 1 in 10 1 in 10 50,K3 SDXK3 N0 8 8 8 160 48 1 | P24 P24-4F-03 CAP 1967 Gutd Meeco NOW 340 8 4 1m10 1m10 20,K3 SDXK3 NO 8 8 8 180 48 | PZ7 P22AVE-01 Guid-Meecia NISE 310 8 5 1 in 8 1n 8 SDX X NA Yes No 0 8 0 0 1 | P27 P22-NF-22 Gurd Macco N9E 310 8 5 1 in 8 1 n 8 5 2 x N M Yes No 0 8 6 0 | P27 P22-W4-03 Gutd Meeto N9E 310 8 5 1 in 8 1n 8 5DX X NA Yes No 0 8 6 0 | P28 P23-WF-01 SACS 1957 Gutd-Maecia N23-W 140 8 5 0 1 in 15 SD K1X No Yes Yes 0 8 75 30 275 1 (ML) | P28 P28+F28 SACS G877 G847 Meecol KEM F8 F0 F1 S0 F1 F0 F1 F0 F1 F1< | P28 P28H=00 SACS 1957 Guild Masco N28V 140 8 5 0 1in15 SD K1X No Yes 0 8 75 0 20 [M1 3 | P33 P33-WF2N SACS 1962 Outd Maxico N39W 145 8 4 1 m10 1 m10 30 K1X 146 146 0 8 3 20 33 111 6 (MU) 1 | P33 P33NF22 SACS F9F2 Gut/d Marcia NS9V 145 8 4 1 in 10 1 in 10 83 K1X V48 V48 V48 0 8 2 40 33 111 8 (MU) 1 | P33 P33MF-03 SACS 1982 Gut/d Macco N33W 145 8 4 11110 11110 SD K1X Yes Yes 0 8 240 33 1111 8 | P34 P344P5-0 \$ACS 1969 Gutd Meeco NG94 178 8 5 1 in 9 1n 9 3C/R2 1K2 1K8 16 1 8 28 2 3 3 1375 | PM PutNet2 SACS 1989 Gut/dimetci NSM TM 8 5 1 in 9 1 n 9 SD/2 K2 Ves Ves Ves 26 26 23 25 1 375 8 | P34 P34/P460 SACS 1989 Guild Macco N39V 178 8 5 1 in 9 1 n 9 SD/Z N2 V68 V68 V68 0 8 285 35 1375 1 | P37 P3748-01 SACS 1987 GMC4Mecco 107 38 4 1 in 0 1in 0 SD/2 K2 K2 K8 V8 0 6 8 16 10 38 (40 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | P37 P37-P37-P37-P42 SACS 1987 GutdMatco 107 8 4 1 in 0 1 in 0 32, 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | P37 P3744-00 SACS 1967 Guild Masco 107 8 4 11110 11110 SD/R2 K2 V68 V68 V68 0 8 150 30 1375 11 | P38 P38-WF2/1 SACS 1961 Gutd Mexico N19V 137 8 4 0 1 in 12 SD K1X No Yes No 0 8 197 30 035 8 (ML) | P38 P38-WF22 SACS 1961 Gutd-Mexico NISM 137 8 4 0 1 in 12 SD K1X No Yes No 0 8 197 30 073 6 (ML) | P38 P38-WC43 5ACS 1961 Gutd Macko NISM 137 8 4 0 11n12 S0 K1X No Ves No 0 8 197 30 (M3) | P40 P40NFc0 SACS 1983 Guid Meeco N19V 180 8 5 1 in 10 111 0 SDX K1X Yes Yes 0 8 7 180 30 (M) | P40 P40NF-02 SACS 1983 Quird Meeted N19V 180 8 5 1 m10 1 m10 SDX K1X Yes Yes 0 8 180 30 (40) | P40 P40/F40 SACS 1983 Gard Maxico N19V 180 8 5 1 in 10 1 in 10 SDX K1X Yes Yes Yes 0 8 190 20 (10 (ML) |

| Dataset of pushover results |
|-----------------------------|
| Table 2.1 |

| Defi. Defi. Nov | asured | | | | | | | | | | | | | | | | | | | | | | | | | Deck. +)41' | Deck. +)41 | | | | | | |
|---|---|--|--|--|---|---------------------------------------|---------------------------------------|---|---|---|---|------------------------------------|------------------------------------|------------------------------------|---|---|---|--|--|--|---|---|--|--|--|--------------------------|--------------------------------------|---|---|---|-----------------------------------|-----------------------------------|-------------|
| Defl. D | imate Me | Ξ | 2.5 | 17 | | 35 | 39 | 33 | 17 | 7 | 13 | 8 | 80 | 8.5 | 1.5 | 6 | 6 | | | | | | | | | 30 E | 24 E | 22 | 20 | 33 | | | |
| 84 | first (in) Loa | | + | | | | | | | | - | | | | + | | | | | _ | | | | | | ., | | | | | | | |
| | CO Yield | | | _ | | | | | | | | | | | | | | | | _ | | | | | | | | ñ | - | | | | |
| Membe Type | (Tension, mpressic | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BS at First | Member Yield | | | | 006 | | | | | | | | | | | | | | | | | | | | | | | 6650 | 5672 | | | | |
| majore | anism | w Mudline | ge | ge | lure [/] nt > 5* | ge | e | ge | alure | alure | alure | əɓ | ge | ge | ab | ge | ge | failure d piles. | failure d piles. | failure d piles. | d piles. failure | d piles. d | falure d nice | failure d piles. | failure d piles. | lle. | mber and ing shear | ge | ge | ge | и | uo | |
| TION | il ure Mech | Yield Belo | Piles Plur | Piles Plur | Frame Fail (splacemer | Ples Hin | Piles Hin | Piles Plur | oundation | oundation | oundation | Piles Plur | Piles Plur | Piles Plur | Piles Plur | Piles Plur | Piles Plur | follower follower y failure of | follower follower y failure of | follower follower y failure of | followe followe y failure of oundation | followe y failure of oundation followe | y failure of oundation i follower | follower | follower follower v failure of | Jacket, F | # (local me can punch failures | Piles Plur | Piles Plur | Piles Plur | Foundati | Foundat | |
| ORMAT ate ste Fai | ar ar | 5 Piles | | 0 | 3 | 2 | 5 | 8 | 7 Fc | 4 F | 4 F | 4 | 80 | 2 | 0 | 0 | 4 | 9 9 | 0 0 | പ്രം | 4 I DE | 0 4 0 T | 0 0 0 1 0 1 1 | 9 9 9 | с й 0 | 2 | Jacke joint | \$ | 9 | 4 | 40 | 6 | |
| Ultim Bas | She (Kip | 54 177 | 196 | 31 230 | 05 442 | 91 327 | 316 | 94 302 | 86 260 | 21 | 54 230 | 11 236 | 91 207 | 96 198 | 70 314 | 304 | 48 334 | 90 531 | 27 522 | 22 | 58 510 | 27 534 | 555 | 96 547 | 14 538 | 352 | 80 347 | 55 768 | 680 | 25 706 | 262 08 | 56 421 | |
| ESSME | Base Ri | 67 0. | | 5 | 00 biated 1. ndrew | 94 0. | 6 | 91 0. | 21 0. | 0 8 | 96 | 35 1. | 81 | 6 | 97 0. | | 58 | 56 1. | 97 2. | 20 | 77 2. | 52 2. | 32 0. | 24 0. | 21 | 0 | 0 | 8 - | | 33 2. | 92 1. | 12 1. | |
| ASS | e Year | 12 L | al | de 17 | 42 de (interp from A | 35 | al 45 | de 35 | .99 | al 41 | de 42 | n 21: | al 22 | de 23 | 44 | a | de 22 | (0) 29 | al 22 | 6 20 | al 19. | a 23 | 90 20 | al 57. | al 47. | al | ę | 64 C | al | de 31: | n 24 | 27 | |
| Directio | of Wav | EndOr | Diagon | Broadsk | Broadsli | EndOr | Diagon | Broadsk | EndOr | Diagon | Broadsi | EndOr | Diagon | Broadsi | EndOr | Diagon | Broadsi | EndOn (| Diagon. (45) | Broadsi (90) | Diagon (135) | (190) Diagon | Broadsi (270) | Diagon (290) | Diagon: (315) | Diagon | Broadsi | EndOr | Diagon | Broadsk | EndOr | Diagona (22.35 | |
| Wave i Dack | t Deck (Yes/No | | | | | Yes | Yes | Yes | Yes | Yes | Yes | N | Ŷ | Ŷ | N | Ŷ | No | No | Ŷ | Ŷ | 2 N | 2 2 | Ŷ | Ŷ | Ŷ | | | | | | No | N | |
| d Deck | ed Weigl | | | | | | | | | 6 | | | | ~ | | ~ | ~ | 1385 | 1380 | 1380 | 138: | 138: | 1383 | 1385 | 1380 | | | | | | 1521 | 1521 | |
| orm Win | (ft) (knc | 2.7 71 | 2.7 71 | .48 68 | | 32 77 | 197 74 | .48 66 | 22 6€ | 85 55 | | 32 77 | 2.7 71 | 197 74 | 2.7 71 | .48 68 | 1.48 68 | | | _ | | | | | | | | 5.1 94 | 4.4 85 | 4.4 86 | 3 70 | 3 70 | |
| urrent St | (knot) S | 1.75 | 1.75 | 1.67 2 | | 1.95 | 1.87 2 | 1.67 2 | 1.56 | 1.35 | | 1.95 | 1.75 | 1.87 2 | 1.75 | 1.67 2 | 1.67 2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 2.09 | 2.09 | 2.09 | | | 2.6 | 2.4 | 2.4 | 2.7 | 3 | |
| Time | (sec) | | | | | 12.8 | 12.6 | 12.2 | 11.9 | 11.5 | | 12.8 | 12.4 | 12.6 | 12.4 | 12.2 | 12.2 | | | | | | | | | | | 14.1 | 13.7 | 13.7 | 12.5 | 12.5 | |
| Wave Heicht | (f) | 1 55 | 1 55 | 1 52.5 | 2 | 60 | 57.5 | 525 | 50 | 45 | 47.5 | 60 | 55 | 57.5 | 3 55 | 3 52.5 | 3 52.5 | .) 53.6 | .) 44.2 | ,) 44.2 | () 44.2 | 56.8 | 63.1 | 63.1 | , 59.9 | | | 75 | 70 | 70 | 2 51.75 | 2 57.5 | |
| Lowe | g € € | 1.8 22.4 | 1.8 22.4 | 1.8 22.4 | 25 34.7: | 2 26 | 2 26 | 2 26 | 2 26 | 2 26 | 2 26 | 8 43 | 8 43 | 8 43 | 13 37.3: | 13 37.3 | 13 37.3: | -2 40 (TOS | .2 40 (TOS | 2 40 (TOS | ¹² (TOS | 2 2 2 4 10 20 20 20 20 20 20 20 20 20 20 20 20 20 | 2 40 (TOS | 2 40 (TOS | 2 40 (TOS | 40 | 40 | 4 40 | 4 40 | 4 40 | 12 38.9. | 52 38.9: | |
| | ¥ soi (± @ | -14 | 4 | 41- | -12 | ÷ | ÷ | -11 | 11- | ÷ | ÷ | 53 | 29 | 29 | 0.1 | 0.1 | 0.1 | 8 | 8 | 4 | 4 | 9 9 | 4 | 4 | 4 | | | õ | õ | 70 | 9.0 | 0.5 | |
| NFORM, Leg Numb | ing Elevat | e. | | | 2 | 3 | e | 3 | 3 | e | ~ | 2 | 5 | 5 | 3 | e. | 3 | | | en | e | | e. | e | e. | | | e. | | 3 | 8 | 3 | |
| Deck I | Spac | <u> </u> | <u>a</u> e a | 0 e 0 | | 6 Â Â | <u>6 Â Â</u> | (Q) (Q) | | -65 | 0.6.5 | (Q) (Q) | ĝâ | ĝâ | co) | - 0 . | (D) | <u> </u> | <u> </u> | <u> </u> | 5 | - 22 - | 20 | | <u> </u> | | | 885 | 885 | 0.00 | <u>6</u> - | ô - | |
| Dack Sine | Deck Size | 0'x28.75' (S 0'x115' (CL 'x161.8' (M |)'x28.75' (S 0'x115' (CL 'x161.8' (M | 0'x28.75' (S 0'x115' (CL 'x161.8' (M | | ZX34.3 (Sl 8X117.8 ((8X148' (M | ZX34.3 (Sl 8X117.8 ((8X148' (M | ZX34.3 (Sl 8'X117.8' ((8'X148' M | 22'X60' (SD 3'X115' (CL 1'X148' (ME | 22'X60' (SD 3'X115' (CL 1'X148' (ML | 22'X60' (SD 3'X115' (CL 1'X148' (ML | 5X117.5 ((5X162' (M | 5X117.5 ((.5X162' (M | 5'X117.5 ((\5X162' (M | 20'x45' (SD 83'x133.2' (- 5.83'x133.2 | 20'x45' (SD 83'x133.2 (5.83'x133.2 | 20'x45' (SD B3'x133.2 (5.83'x133.2 | 5'×32.67" (S 10'×98' (CD 5'×114' (ME | 5'x32.67" (S 10'x98' (CD 5'x114' (ME | 5'x32.67" (S 10'x98' (CD 5'x114' (ME | 5'X114'(MC 3'X114'(MC 3'X114'(MC | 40'x98' (CD 6'x114' (Mf ''x32.67' (SI ''x32.67' (SI | 6'x114' (MI 5'x32.67' (S 10'x98' (CD | 5'X32.67' (S 10'X98' (CD 5'X114' (ME | 5'x32.67" (S 10'x98' (CD 5'x114' (ME | | | 5x62.5 (SI 0x165' (CL 0'x165' (ML | 5x62.5 (St 0x165' (CL 1'x165' (ML | 5x62.5 (SI 0x165' (CL 7'x165' (ML | 19'x70' (ME 90'x40'(CD) | 19'x70' (ME 30'x40'(CD) | 19'270' (ME |
| mber of | ductor | 0 4 10 | 0 4 1 | 0 4 1 | | 2 8 42. 42 | 8 22 | 2 8 42. 42 | 16 4.4 | 6 4. 4. | 16 | 0 42. | 0 42. | 0 42. | 16 45.1 | 16 45. | 16 45. | 11 20 20 | ¢ ، ¢ | = · • : | | | -=== ================================= | | ≓ . © | | | 24 24 | 24 5 | 24 5 7 | 14 | 14 | ÷ |
| NN SI S | In) Con | | | _ | | 1.75 ML) | (.76 ML) | NL) | ML) | ML) | ML) - | 1 ML) | ML) | ML) | 1.25 ML) | ML) | 1.25 ML) | | | | | | · · | | | | | 1.75 ML) | | ML) | .75- | .75- | × |
| NOI % | 9 (ij | | | _ | | 30 | 8 | 30 | 30 | 90 | 9 8 | 30 (1 | 90 | 90 00 | 36 1 - 1 | 8 | 36 | 90 | 8 | 8 | 8 | 8 8 | 8 | 8 | 8 | | | 4 7 | 54 1 () | 42 () | 36 | 8 | • |
| FORMA ual Pile | (ft) | | | | | 260 | 260 | 260 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 182 | 182 | 8 | 182 | 182 | 182 | 8 | 182 | | | 330 | 330 | 330 | 160 | 160 | |
| mber Act | Leg Per. | 80 | 8 | 80 | 8 | 8 | 8 | 8 | 8 | 80 | 80 | 8 | 80 | 80 | 8 | 80 | 8 | 8 | 80 | 8 | 8 | 8 8 | 8 | 8 | 8 | 80 | 8 | 80 | 80 | 8 | 8 | 8 | |
| of Nur | skirt of iles P. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 9 | 10 | 6 6 | 10 | 5 | 5 | | | 0 | 0 | 0 | 0 | 0 | |
| iles Nu. | servo) P. | | | _ | Yes | Ŷ | ٩ N | No | N | 0N | 8 | Yes | se , | se X | Kes | 268 X 68 | Kes | (Main) Yes Xúrt) | (Main) Yes Wirt) | (Main) Yes Wirt) | (wain) Yes Skirt) Main) | Yes Skirt) (Main) (es | Skirt) (Main) r es akirt) | (Main) Yes Xort) | (Main) Y es Sóirt) | | | Kes | 8 | Yes | Yes | 8 | |
| oint Gr | ssNo) (Ye | Yes | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes 7 | Yes . | Yes . | Yes No. | Yes No. | Yes No. | Yes Vo | Yes No(| Yes No: | Yes No. (S) | Yes No. | Yes | Yes | Yes | Yes . | Yes | No | NN N | |
| Lap J | vio/NA) (Yr | | | | | ol | 9 | oj | es | se | ee | es | se | se | es | es | es | - | | | | | - | | | | | VI | M | VI | | | |
| Over (K-lo | g (KJ) K2) (Yes/h | | | | | z | z | z | * | ۶ | ~ | × | ۶ | ۶ | ۶ | ۶ | 5 | | | _ | | | | | | | | z | z | × | | | |
| IATION Trans. Bracing | Bracin (SD,X,K1, | K1X | K1X X | K1X | K1,K2 | K1,X | K1,X | K1,X | К1,Х | K1,X | K1X | K1,X | K1,X | K1,X | Ø | 8 | Ø | Q | Q | 2 | 2 | g g | Q | 8 | 2 | SD,K3 | SD,K3 | SD | SD | SD | K2,X | K2,X | |
| NFORM Long. | Bracing X,K1,K2) | SD, X | SD, X | SD, X | ß | SDX | SD,X | SDX | SD,X | SD,X | SD,X | SDX | SD,X | SDX | SD,K2 | SD,K2 | SD,K2 | SD | ß | ß | ß | 8 8 | ß | ß | ß | ß | 8 | ß | ß | SD | SDX | X'OS | |
| CKET I | atter (SL | | | _ | 8 H 1 | in 10 | in 10 | in 10 | in 10 | in 10 | in 10 | in 10 | in 10 | in 10 | 6 U . | 6 u a | 6 u 1 | in 20 | in 20 | in 20 | in 20 | in 20 in 20 | in 20 | in 20 | in 20 | in 10 | in 10 | 8 ii 8 | 8 ui 1 | in 8 | 8 H . | in 8 | |
| AL ang. Tr. | Batter B | | | | 1 in 8 1 | in 10 | in 10 | in 10 1 | in 10 1 | in 10 | in 10 | in 10 1 | in 10 | in 10 | 1 in 9 | 1 in 9 | 1 in 9 | 1 in 6 1 | 1 in 6 | 1 in 6 | 1 in 6 | 1 in 6 1 in 6 1 it | 1 in 6 | 1 in 6 | 1 in 6 | in 10 1 | in 10 1 | 1 in 8 | 1 in 8 | 1 in 8 1 | 1 in 8 | 1 in 8 | |
| | of Eays | 4 | 4 | 4 | 4 | 4 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 9 | 10 | ю | υ | | 5 | w | - | ب د | 5 | 4 | -1 | 4 | 9 | 9 | |
| of | of Legs | 8 | 8 | 80 | 8 | 8 | 8 | 8 | 8 | 80 | 80 | 8 | 80 | 80 | 8 | 8 | 8 | 8 | 8 | 80 | 8 | 8 8 | 8 | 80 | 8 | ø | 80 | 8 | 80 | 8 | 8 | 80 | |
| lumber of | ÷ | | 137 | 137 | 118 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 141 | 14 | 141 | 160 | 160 | 9 | 160 | 00 1 00 | 9 | 60 | 160 | 223 | 223 | 211 | 211 | 211 | 184 | 184 | |
| Water Number Number | Dep | 137 | | _ | | 36W | N36W | N36W | N36W | N36W | N36W | N36W | N36W | N36W | | | | N2.8E | N2.8E | N2.8E | N2.8E | N2.8E 42.8E | 42.8E | V2.8E | N2.8E | | | | | | VISBW | NSBW | |
| entation Water Number Number | IE North Dep (TN) | 137 | | | N1V | ¥ | | ~ | ~ | ÷ | ~ | Ê. | Ĩ. | - | 0 | c o | ico | skico h | axico h | exico h | exico 1 | exico exico | exico | lexico h | texico h | lexic o | exico | exico | ic o | 00 | 60 | - 00 | |
| ATION Orientation Vater Number Number | ion True North Dep (TN) | 4exico 137 | fexico | fexico | fexico N1M | fexico NC | fex ic o | fexic o | fexico | fexico | fexico | texico | texico | fexic | fexio |) jej | - B | | | | | - | - | | | | - | | ê i | fex | (ex | je j | |
| NFORMATION Orientation Water Number Number | d Location True North Dep | Gulf of Mexico 137 | Gulf of Mexico | Gulf of Mexico | Gulf of Mexico N1M | Gulf of Mexico NC | Gulf of Mexico | Gulf of Mexico | Gulf of Mexico | Gulf of Mexico | Gulf of Mexico | Guff of Mexico | Guff of Mexico | Gulf of Mexico | Gulf of Mexic | Gulf of Mex | Gulf of Mee | Gulf of Me | Gulf of Me | Gulf of M | Guff of M | Guff of M Guff of M | Gulf of M | Gulf of M | Gulf of N | Gulf of N | Gulf of M | Gulf of M | Gulf of Mea | Guff of Mexi | Gulf of Mex | Guff of Mexi | |
| ORM INFORMATION Vear Orientation Water Number Number | e Installed Location True North Dep | 1368 Gulf of Mexico 137 | 1968 Gulf of Mexico | 1968 Gulf of Mexico | 1964 Guff of Mexico N1W | 1962 Gulf of Mexico N | 1962 Gulf of Mexico | 1962 Gulf of Mexico | 1964 Gulf of Mexico | 1964 Gulf of Mexico | 1964 Gulf of Mexico | 1964 Gulf of Mexico | 1964 Gulf of Mexico | 1964 Gulf of Mexico | 1966 Gulf of Mexic | 1966 Gulf of Mex | 1966 Gulf of Mee | 1965 Guif of Me | 1965 Gulf of Me | 1965 Guif of M | N 1965 Gulf of M | N 1965 Gulf of M 1965 Gulf of M | 1965 Gulf of M | 1965 Gulf of M | 1965 Gulf of N | 1965 Gulf of N | 1965 Gulf of M | 1978 Guif of M | 1978 Gulf of Mee | 1978 Gulf of Mexi | 1968 Gulf of Mexi | 1968 Gulf of Mexi | |
| PLATFORM INFORMATION | Software Installed Location True North Dep | SACS 1968 Gulf of Mexico 137 | SACS 1968 Gulf of Mexico | SACS 1968 Gulf of Mexico | USFOS 1964 Gulf of Mexico N1M | SACS 1962 Gulf of Mexico N | SACS 1962 Gulf of Mexico | SACS 1962 Gulf of Mexico | SACS 1964 Gulf of Mexico | SACS 1964 Gulf of Mexico | SACS 1964 Gulf of Mexico | SACS 1964 Gulf of Mexico | SACS 1964 Gulf of Mexico | SACS 1964 Gulf of Mexic | SACS 1966 Gulf of Mexic | SACS 1966 Gulf of Mex | SACS 1966 Gulf of Mee | KARMA 1965 Guff of Me | KARMA 1965 Guff of Me | KARMA 1965 Guif of M | KARMA 1965 Guif of M | KARMA 1965 Gulf of M KARMA 1965 Gulf of M | KARMA 1965 Gulf of M | KARMA 1965 Gulf of M | KARMA 1965 Gulf of N | 1965 Gulf of N | 1965 Guff of M | SACS 1978 Gulf of M | SACS 1978 Gulf of Mee | SACS 1978 Gulf of Mexi | KARMA 1968 Guff of Mexi | KARMA 1968 Gulf of Mexi | |
| PLATFORM INFORMATION ust-Over Sedwarea Year Location Orientation Water Number Number | ID Software Installed Location True North Dep | 241-NF-01 SACS 1968 Gulf of Mexico 137 | 341-NF-02 SACS 1968 Gulf of Mexico | 241-NF-03 SACS 1968 Guff of Mexico | 244-NF-01 USFOS 1964 Guff of Mexico N1M | 345-NF-01 SACS 1962 Guff of Mexico N | 246-NF-02 SACS 1962 Gulf of Mexico | 245-NF-03 SACS 1962 Guff of Mexico | 246-NF-01 SACS 1964 Guff of Mexico | 246-NF-02 SACS 1964 Guff of Mexico | 246-NF-03 SACS 1964 Guff of Mexico | 247-NF-01 SACS 1964 Guff of Mexico | 247-NF-02 SACS 1964 Gulf of Mexico | 247-NF-03 SACS 1964 Guff of Mexico | 248-NF-01 SACS 1966 Gulf of Mexic | 348-NF-02 SACS 1966 Gulf of Mex | 248-NF-03 SACS 1966 Gulf of Mee | 52-NF-01 KARMA 1965 Guit of Me | 252-NF-02 KARMA 1965 Guff of M | >52-NF-03 KARMA 1965 Guff of M | P52-NF-04 KARMA 1965 Guf of M | P52.NF-05 KARMA 1965 Guf of M 152.NF-06 KARMA 1965 Guf of M | 752-NF-07 KARMA 1965 Gulf of M | 252-NF-08 KARMA 1965 Guff of M | 32.NF-09 KARMA 1965 Guif of h | >53-NF-01 1965 Gulf of N | 253.NF-02 1965 Guff of M | 754.NF-01 SACS 1978 Gulf of M | 254-NF-02 SACS 1978 Gulf of Mee | 54-NF-03 SACS 1978 Guff of Mexi | 255-NF-01 KARMA 1968 Guff of Mexi | 255-NF-02 KARMA 1968 Gulf of Mexi | |

| of pushover results | |
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| able 2.1 Dataset | |

| | de defl. basured | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|---|---|--------|---|--|---|---|--|---|---|--|--|---|--|--|---|---|--|--|--|--|--|--|---|--|--|---------------------------------|
| | hefi. at No imate Me ad (in) | | | 12 | 1.5 | 17 | | | | 15 | ÷ | 13.5 | 28 | 24 | 22 | 11.5 | 6 | 12.5 | 13.5 | 13 | 4 | 50 | 20 | | | | |
| | efi. First UP d (in) Lo | | | 6.5 | 6 | 12 | | | | | | | 2.5 | 2.5 | ÷ | | | | | | | | | | | | |
| | e D e. n,Co Yiel ion) Yiel | | | | | | | | | | | | - | - | | | | | | | | ssion | ssion | | | | |
| | Memb Typ (Tension mpress | | | | | | | | | | | | | | | | | | | | | Compres | Compre | | | | |
| | BS at First Member Yield | 6400 | | 1957 | 2362 | 2563 | 6039 | | | | | | 3405 | 3695 | 3944 | | | | | | | 726 | 1054 | | | | |
| ATION | ⁼ ail ure Mechanism | ompression Member Buckle | | Piles Plunge | Piles Plunge | Piles Plunge | Jacket, Piles | | | ⁻ oundation Failure in Tripod | Foundation Failure | Foundation Failure | nging of Platform Piles | nging of Platform Piles | nging of Platform Piles | Foundation Failure | Foundation Failure | Foundation Failure | ripod piles pull-out or plunge | acket and tripod piles pull-out or plunge | Piles Pull Out | Leg/Pile | Leg/Pile | | | | |
| FORM/ | imate ase hear ips) | 3482 C | | 413 | 598 | 853 | 394 | 600 | 200 | 1 180 | 521 | 969 | 869 Hil | 229 Hi | 419 Hi | 930 | 720 | 333 | 789 T | 037 J | 249 | 040 | 302 | 568 | 083 | 007 | |
| ENT IN | RSR SI | 3.78 | | 0.99 2 | 5 | 1.83 2 | 2.8 9 | 2.43 5 | 2.48 5 | 0.52 2 | 5 | 0.85 2 | 0.52 3 | 4 | 127 4 | 1.13 3 | 0.78 3 | 0.77 4 | 0.56 2 | e. | 1.06 3 | 2.68 3 | 1.94 | 1.99 3 | 1.54 2 | 1.47 3 | |
| SESSM | 1100- r Base hear | 2300 | | 447 | | 557 | 1355 | 300 | 300 | 315 | | 168 | 444 | | 472 | 474 | 784 | 612 | 964 | | 650 | 134 | 185 | 793 | 349 | 043 | |
| AS | tion Yea ave S | ~ | | on 2 | Iano | side | | side 2 | δ | u o | Ind | side | u n | onal | side | u o | anal 4 | side | 4 U | Inni | side | ۰ 5 | nal | side 1 | nal f | δ | |
| | s in ik No) of W | ž | | s End | s Diago | s Broad | 0 | Broad | End | s End | s Diago | s Broad | s End | s Diago | s Broad | s End | s Diago | s Broad | s End | s Diago | s Broad | End | Diago | Broad | Diago | End | |
| | ck Wave ght Dec s) (Yes/ | N 00 | | Ye | Ye | Ye | 20 Ye | × 8 | ¥ 8 | Ye | Ye | ¥e | Ye | , Š | Ye | Ye | Ye | Ye | Ye | Ye | Ye | ž | ž | Ň | ž | ž | |
| | find De seed Wei tot) (kip | 0.04 297 | | 80 | 80 | 80 | 27. | 52 | 52 | 85 | | | 5 | 5 | 11 | 12 | 88 | 88 | 92 | 55 | 88 | 85 | 35 | 50 | | | |
| | Storm W Surge Sp (ft) (kr | 1.1168 10. | | 3.52 { | 3.52 { | 3.52 { | | | | 22 (| | | 2.7 | 2.7 | 2.7 | 2.7 | 2.48 (| 2.48 (| 22 (| 22 (| 2.48 (| - | - | 3 (| | | |
| | Current ^S (knot) | 1.9425 3 | | 2.08 | 2.08 | 2.08 | | | | 1.65 | | | 1.75 | 1.75 | 1.75 | 1.75 | 1.67 | 1.67 | 1.65 | 1.55 | 1.67 | 2.3 | 2.3 | - | | | |
| | t Period (sec) | 15.7 | | 13 | 13 | 13 | | | | 11.9 | | | 12.4 | 12.4 | 12.4 | 12.4 | 12.2 | 12.2 | 11.9 | 11.9 | | 13.5 | 13.5 | 11.5 | | | |
| L | k Wave k Heigh | 1 80.052 | | 6 62.5 | 6 62.5 | 6 62.5 | | | | 50 | 47.5 | 47.5 | 55 | 55 | 55 | 55 | 525 | 52.5 | 3 50 | 2 20 | 52.5 | 58 | 58 | 26 | | | |
| | ir Low ap Elev (1) (1) | 67.9 | | 34 38.0 | 34 38.0 | 34 38.0 | .8 32 | 3 40 | 3 40 | .7 34 | .7 34 | .7 34 | .8 34 | 34 | .8 34 | 3.3 26 | 0.3 26 | 0.3 26 | 941 | 6 34.6 | .6 34.6 | .3 44 | .3 44 | 2 31 | 2 31 | 2 31 | |
| ATION | er of A ck Gs tions (f | | | Ŷ | Ŷ | Ŷ | <u>9</u> - | ÷ | - | 4 | 4 | 4 | ę. | ~ ~ | | -10 | ų. | ų. | -2 | -7 | -2 | = | = | 8 | ø | 8 | |
| CK INFORM | Deck Leg Spacing Elevat | | | 2 | 5 | 2 | | | | 2 | 5 | 5 | 3 | e. | e | 3 | e. | | 2 | 2 | 2 | 2 | 5 | - | - | - | |
| DE | Deck Size | 154.20/213.25# | cs | | | | | | | 40'x115' (CD) 55'x145' (MD) | 40×115' (CD) 55'×145' (MD) | 40'x115' (CD) 55'x145' (MD) | 20'x63' (SD) 54'x131' (CD) 54'x131' (MD) | 20'x63' (SD) 54'x131' (CD) 54'x131' (MD) | 20'x63' (SD) 54'x131' (CD) 54'x131' (MD) | 22x63 (SC) 52.5X117.5 (CD) 42.5x148 (MD) | 22x53 (SC) 52.5X117.5 (CD) 42.5X148 (MD) | 22x53 (SC) 52.5X117.5 (CD) 42.5x148 (MD) | 120'x40' (CD) 150x40' (MD) | 120'x40' (CD) 150x40' (MD) | 120'x40' (CD) 150x40' (MD) | | | 52'x90' | 52'x90' | 52'x90' | |
| Γ | lumber of onductor s | 36 | > 8 LE | 0 | 0 | 0 | 39 | 56 | 56 | 16 | 16 | 16 | 6 | 6 | 6 | 12 | 12 | 12 | | | | 14 | 14 | | | | |
| NO | ile Pile ^N D WT Cc n) (in) Cc | 046 3.5066 | | 0 1 (ML) | 0 (ML) | 0 1 (ML) | 96 1.5 | | 9 | 00 0.75 (ML) | 0 0.75 (ML) | 0.75 (ML) | 0 0.75 (ML) | 00 0.75 (ML) | 0 0.75 (ML) | 0 0.75 | 0 0.75 | 0 0.75 | 0 0.75 | 0 0.75 | 0 0.75 | 0 0.625 | 0.625 | 8 | 8 | 8 | |
| ORMAT | al Pile F tration (ft) (| 9168 60 | | 70 | 20 | 20 | | 96 | 85 | 30 | 30 | 30 | 20 | 20 | 20 | 88 | 88 | 88 | 901 | 90 | 90; | 50 | 50 | 2-141 | 2-141 | 2-141 | |
| LES INF | mber Actu Leg Pene iles (| 4 150 | | 10 2 | 10 | 10 | 12 | 12 | 12 | (14) 2 | (14) 2 | (14) 2 | (14) | (14) | (14) 2 | (14) 1 | (14) | (14) | (14) 2 | (14) | (14) 2 | 16 1 | 16 | 132 | 132 | 132 | |
| Ē | nber Nu of Nu kirt of lies P | 8 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 8 | 8 | 8 | 0 8 | ø o | ø o | 0 8 | 8 | 0 | 0 8 | 0 | 0 8 | 0 | | | | | |
| | outed S es/No) PI | 88 | | Yes | ¥es | Yes | Yes | Yes | N/A | Yes | Yes | ×es | o'Yes | o/Yes | o/Yes | Yes | ×68 | se , | Yes ipods) | Yes ipods) | Yes ripods) | Yes | 8 | | | | |
| F | Joint F Can Gr es/No) (Y | Yes | | Yes | | | Yes | | | Yes | Yes | Yes | Yes N | Yes | Yes | Yes | Yes | Yes | Yes (Tr | Yes (T | Yes (T | NN. | ۶ ۶ | N | ß | N. | |
| | OverLap (K-Joints) (Yes/No/NA) (Y | е | | Yes | Yes | Yes | NA | | | N | N | N | Yes | Yes | Yes | No | N | N | | | | NA | W | | | | |
| ATION | Trans. Bracing (SD,X/K1,K2) | k2 | | Ø | ğ | ¥ | SD | SD,K1 | SD,K1 | K1X | K1X | K1X | K1X | K1X | K1,X | K1X | K1X | K1X | K1X | K1X | K1X | × | × | SD,X,K2 | SD,X,K2 | SD,X,K2 | |
| INFORM | Long. Bracing SD,X,K1,K2) | Z | | SD | SD | SD | ßD | SD | ß | X'OS | SDX | SD,X | X, UX | SD,X | SD,X | хах | SD,X | SDX | SD | SD | ß | × | × | SD | SD | SD | |
| ACKEI | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Trans. Batter | 1 in 5 | | 1 in 10 | 1 in 10 | 1 in 10 | | 1 in 8 | 1in 8 | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 10 | 1 in 10 | 1in 10 | 1in 10 | 1in 10 | | | | 0 | 0 | | | | |
| | Long. Trans. Batter Batter | 0 1h5 | | 1 in 10 1 in 10 | 1 in 10 1 in 10 | 1 in 10 1 in 10 | | 1 in 8 1in 8 | 1 in 8 1in 8 | 1 in 10 1 in 10 | 1 in 10 1 in 10 | 1 in 10 1 in 10 | 1 in 10 1 in 10 | 1 in 10 1 in 10 | 1 in 10 1 in 10 | 1 in 10 1in 10 | 1 in 10 1in 10 | 1 in 10 1in 10 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Number Long. Trans. of Batter Batter | 4 0 1h5 | - | 5 1 in 10 1 in 10 | 5 1 in 10 1 in 10 | 5 1 in 10 1 in 10 | 4 | 5 1 in 8 1in 8 | 5 1 in 8 1in 8 | 6 1 in 10 1 in 10 | 6 1 in 10 1 in 10 | 6 1 in 10 1 in 10 | 5 1 in 10 1 in 10 | 5 1 in 10 1 in 10 | 5 1 in 10 1 in 10 | 4 1 in 10 1 in 10 | 4 1 in 10 1 in 10 | 4 1 in 10 1 in 10 | 5 0 | 0 | 5 0 | 4 0 | 4 0 | 4 | 4 | 4 | |
| | Number Number Long. Trans. of Legs Bays Batter Batter | 8 4 0 1n5 | | 10 5 1 in 10 1 in 10 | 10 5 1 in 10 1 in 10 | 10 5 1 in 10 1 in 10 | 12 4 | 12 5 1 in 8 1in 8 | 12 5 1 in 8 1in 8 | 8 (14) 6 1 in 10 1 in 10 | 8 (14) 6 1 in 10 1 in 10 | 8 (14) 6 1 in 10 1 in 10 | 8 (14) 5 1 in 10 1 in 10 | 8 (14) 5 1 in 10 1 in 10 | 8 (14) 5 1 in 10 1 in 10 | 8 (14) 4 1 in 10 1 in 10 | 8 (14) 4 1 in 10 1 in 10 | 8 (14) 4 1 in 10 1 in 10 | 8 (14) 5 0 | 8 (14) 5 0 | 8 (14) 5 0 | 16 4 0 0 | 16 4 0 0 | 36 4 | 8 | 36 | |
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3.0 RULES OF DEVELOPMENT

3.1 BACKGROUND

With the increasing emphasis on the nonlinear behavior of platforms, it is important to understand the factors influencing their behavior and ultimate strength. In this study, the primary factors affecting platform strength were the number of legs, vertical bracing scheme, vintage, pile grouting, wave in deck, and conductors. Other factors having some effect on platform behavior include overlap of K-joint in K-braced frames, batter of the frames, and effects of plan bracing configurations.

3.2 FACTORS AFFECTING THE RSR

3.2.1 Number of legs

Six- and eight-leg platforms are known to be more redundant than three- and four-leg platforms. The number of legs and type of bracing system can be strong indicators of the overall redundancy and damage tolerance of a platform. In this study the platforms have been grouped into:

- < 4 leg platforms</p>
- 4 leg platforms
- 6 leg platforms
- 8 leg platforms
- >8 leg platforms (8 leg platforms interconnected to two 3 leg auxiliary platforms were also included in this group).

3.2.2 Bracing system

The reserve strength of a platform depends upon the nonlinear behavior of components and the interaction between the components. X-braced platforms are known to be more damage tolerant than K-braced and diagonally braced platforms. In an X-braced frame, after the compression brace buckles, the frame can still carry an additional load through the tension brace. However, the degree of reserve strength depends on the slenderness of the braces and the redundancy throughout the structure, as described in Section 4.

An operator can take advantage of the robustness of an X-braced platform in developing an underwater inspection strategy [2]. This might include extending the interval of periodic underwater inspections. In addition, should significant damage be found during the underwater inspection, the operator might be able to demonstrate that immediate repair is not necessary due to the availability of alternate load paths. Such an approach would allow time for engineering assessment, planning, and evaluation of alternatives.

In the case of K-braced frames, if failure occurs in a K-brace, the load path through the panel is lost and the response is brittle. If the braces are designed to the same codes, the reserve strength of the K-panel will be equal to the safety factor adopted, whereas for the X panel, it may be greater due to the tension brace contribution. This will be demonstrated further in Section 4 for the 2-D frame analysis and is also observed in Section 5 in the dataset analysis.

For diagonal-braced frames, if the compression brace buckles, the frame action in the bay will be lost. If the brace were in tension, and the brace were to yield, frame action is not lost and

failure would be more gradual, since tension failures are ductile. A further demonstration of this is also provided in Section 4.

API RP 2A [1] provides guidelines for the ductility requirements in seismically active areas. Although these guidelines were developed for earthquake loading, they can also be used in assessing the redundancy of a structure and the availability of alternative load paths in general. The guidelines include:

- The provision of sufficient system redundancy such that the load redistribution and inelastic deformation will occur before collapse therefore minimizing the abrupt changes in the lateral stiffness of the structure. This provides for a ductile vs. catastrophic brittle failure mode.
- Configure members in vertical frames to provide for redistribution of the horizontal shear loads as buckling occurs in the diagonal bracing and to improve the post-buckling behavior of the diagonal braces. This effectively allows the platform to absorb energy from the earthquake (via member failure) and therefore "survive" an extreme event earthquake, although the platform may be damaged. Again the intent is for the designer to build a ductile failure mode into the system.

3.2.3 Vintage

Over the years, design loads used for the platform design have changed. The platforms in the dataset were grouped based on an internal study by EQE International into the following categories, generally based upon step changes in API RP 2A guidelines. The API chronology was chosen as a basis for the categories since a majority of the platforms in the dataset were designed to API standards.

- *Platforms designed after 1994.* Platforms installed during this period were designed in accordance with the API 20th Edition. This is used as a benchmark for all other designs in this study.
- Platforms designed between 1977-1993. These designs were based on API 9th-19th Editions. The 9th edition (1977) was the first version to provide specific 100-year return period criteria, however, the wave load recipe resulted in wave loads below those of the 20th edition, which is now believed to be the most accurate.
- Platforms designed between 1970-1977. These designs were based on early versions of API RP 2A. Although not specified in API RP 2A, designs of this era typically used 100-year return period criteria, but used a wave load recipe that resulted in lower loads. In early years, some platforms likely used the 25-year return period criteria.
- Platforms designed between 1965-1969. There were no API standards at this time. These designs were a combination of 100-year and 25-year return periods. In 1964, Hurricane Hilda damaged numerous platforms and raised concern over the use of 25-year return period criteria.
- Platforms designed before 1964. These designs were typically based on a 25-year or less return period.

The Flooded Member Detection (FMD) JIP by EQE [17] presented data that demonstrates that the occurrence of damage to North Sea platforms increased from 1966 to 1981. This increase in damage was due to the application of design practices for shallow water structures in 60's and 70's to the deeper water structures of the mid to late 70's. Improved design

methods, greater understanding of fatigue, improved fabrication and inspection standards, improved steel quality and improved operating procedures have since reduced the damages. This reduction becomes evident in those platforms installed after 1985.

PMB [4, 6], while studying the effects of Hurricane Andrew on offshore platforms found that a majority of the severely damaged or failed platforms were of 1960's or earlier vintage. No platforms designed to API RP 2A 9th edition (1977) or later were found to have sustained damage or fail during Hurricane Andrew.

3.2.4 Pile grouting

Grouting of the leg/pile annulus is known to improve the strength of members and joints, thereby contributing to the increase in capacity of the platform [9]. Additionally, grouting will increase the rotational restraint imposed by the joint and, thereby, increase the buckling capacity of the connected member(s) [11].

3.2.5 Wave in deck

A number of older platforms are designed for wave heights that are relatively low by current standards. In some cases, these platforms have deck elevations low enough for the platform to experience waves impacting the deck in a large storm or hurricane. This was the lesson learned by operators in the Gulf of Mexico during the 1960's who used a 25-year return period design wave instead of the 100-year return period wave used today.

If the wave crest inundates the deck, there will be a dramatic increase in platform loading due to the increased hydrodynamic area of equipment and the deck itself. When this occurs, the elevation of the centroid of the applied lateral force may be significantly higher than that of a wave that does not inundate the deck. The higher center of force could increase the overturning moment and shift the failure mechanism from a jacket member failure to a deck portal frame or a pile pullout failure [5].

An indication of the wave in deck is measured by air gap, which may be defined as the difference between deck height and the calculated crest of the design wave (100-year). When the air gap is eliminated, a greater area of the platform is exposed and the hydrodynamic loading increases tremendously. In the event of an extreme storm loading, a platform with lower reserve strength and a higher air-gap may have a higher probability of surviving than another structure with a high reserve strength and lower air-gap [8].

3.2.6 Conductors

In most cases, conductors are modeled as load attracting members. Their capability to resist wave loads is sometimes neglected in the original platform design (a conservative practice). For structures with limited foundation resistance, conductors with mudline framing can contribute significantly (up to 10% or more) to the foundation stiffness and collapse strength of the structure.

4.0 PUSHOVER ANALYSIS OF 2-DIMENSIONAL FRAMES

4.1 GENERAL REMARKS

In order to further understand the effect of bracing scheme and damage on the robustness of the platforms and load paths, pushover analyses were performed on two-dimensional frames with five different bracing schemes for the loads shown in Figure 4.1. All were two-bay frames in water depth of 111ft. The SACS suite of programs [3] was used to perform the pushover analyses. The bracing schemes (Figures 4.1 (a) to 4.1(e)) include:

- X-bracing
- K1-bracing (K pointed down)
- K2-bracing (K pointed up)
- Single Diagonal (Compression) bracing
- Single Diagonal (Tension) bracing

This section reports the results of twenty-nine ultimate strength analyses including six pushovers of undamaged frames and twenty-three pushovers in damaged states.

4.2 DESIGN METHODOLOGY USED FOR 2-D FRAMES

The two dimensional frames were designed elastically using the SACS program [3] for the lateral loads of 300 kips and 150 kips located at the top two elevations of the framing. The loads are split between nodes 301, 303 and 201, 203 in order to provide a more accurate representation of distributed wave loads acting on a platform. The total load on the platform is therefore 450 kips. These load values are representative of wave loading for a platform in this water depth [13, 14].

The frames are representative of the platform studied as a part of the API "CBC Analysis Validation" by EQE [13, 14]. The design loads are based on API RP 2A 20th edition. Results of the elastic analyses and member sizes used for the ultimate strength analyses can be found in Appendix A.

For the purposes of this study, overlap of K-joints was assumed in the 2-D model even though this may not hold true in some older platforms. The overlap introduces an element of joint redundancy as the applied load can be partly transferred from one brace to another through their common weld.

The criterion used for member selection was to obtain unity checks for all components as close to unity as possible. While designing the X-braced and K-braced frames, it was found that, the tension braces and horizontals carried negligible loads. Design of these members resulted in smaller diameter and wall thickness (when the unity check was intended to be as close to 1.0 as possible). In practice, however, the compression and tension braces are typically of equal size. Since the compression member design governs the design of vertical braces in a given panel, an alternative design was analyzed in which the member selected for compression was used for tension as well regardless of the resulting unity ratio.

Pushover analyses of these frames show that structural optimization based solely on the linear analysis significantly reduces the reserve strength and the degree of redundancy of the structure, particularly for X-braced frames. A comparison of the pushover analyses of the fully optimized design to the design reflecting common practice for an X-braced frame is

shown in Figure 4.2. In Figure 4.2 and subsequent figures, the load factor is the ratio of factor is the applied load to the design lateral load (450 kips). This figure demonstrates the redundancy contributed by the tension braces, when they are same size as the compression brace.

The latter design (equal compression and tension braces) was used for the study of the robustness of the frames.

4.3 UNDAMAGED FRAMES

This section discusses the behavior of the bracing schemes described in section 4.2 in their intact or undamaged conditions. For this study, the reserve strength ratio (RSR) for a frame is defined as the ratio of lateral load at ultimate strength to design lateral load (450 kips). The performances of the bracing schemes are summarized in Table 4.1 and a comparison of the load-displacement curves is shown in Figure 4.3.

- *X-braced Frame*: In X-braced frames, if one of the compression braces fails, the tension braces resist the load, thus allowing the frame to carry a higher load (recall that the compression braces will fail first due to buckling, with the load taken by the tension braces). In the linear analyses, these tension braces and horizontal braces had very low unity checks. However, in pushover analysis, they act in parallel, thus improving the performance of the frame. Maximum RSR is 2.50.
- *K1-braced Frame*: In the K1-braced frame, if the compression brace buckles, the load path through the bracing is lost. Maximum RSR is 2.43.
- *K2-braced Frame*: In the K2-braced frame, once the compression brace 3-203 buckles, the horizontal brace transfers the additional load, thus maintaining the frame action. The load-deflection curve in Figure 4.3 shows that the frame carries load beyond the buckling of compression braces and reaches a maximum RSR of 2.29.
- *Single diagonal (compression)-braced Frame (SD1)*: In the single diagonal brace-frame, where the braces are in compression, once the compression brace buckles, the frame action is lost. The maximum RSR is 2.38.
- *Single diagonal (tension)-braced Frame (SD2)*: For the single diagonal-braced frame loaded in tension, once the tension brace yields, the load path is not lost and the failure is more gradual. The maximum RSR is 1.99.

4.4 DAMAGED FRAMES

The discussion in Section 4.3 shows how different framing configurations affect the availability of alternative load paths in the system. To understand the robustness of the bracing schemes, and in order to provide information for inspection planning, it is important to understand the behavior of the damaged frames. This section describes the behavior of the frames in different damaged configurations. The damage being considered here is the complete loss of a member, as by brittle fracture, fatigue failure, or collision damage.

In order to study the behavior of damaged frames, the frames were pushed over with one member removed at a time. The sequence of removing the members is shown in Figures 4.4(a)-4.4 (b). The following factors were used to quantify the comparison of the damaged and intact platforms.

Residual strength is defined as the ability of a damaged structure to sustain loads in excess of the design value [2]. Residual strength is measured by the Damage Strength Ratio (DSR) as:

DSR <u>Lateral load at Collapse (damaged)</u> Design lateral load

The performance of a damaged platform in comparison to the intact platform can be measured by the Residual Resistance Factor (RRF). The Residual Resistance Factor is defined as the ratio of lateral load at collapse in the damaged state, to the lateral load at collapse in the undamaged state of the structure [2].

RRF Lateral load at Collapse (damaged) Lateral load at Collapse (undamaged)

The load-displacement curves for the damaged cases are shown in Figures 4.5-4.9 for X-, K1-, K2-, SD1-, and SD2-braced frames, respectively. The load displacement curves for the intact frames are also shown for reference. These cases are discussed as follows:

- *X-braced Frame:* Five damaged cases were analyzed. Figure 4.5 shows the resulting load-deflection curves. Table 4.2, which summarizes the DSRs of the damaged cases, shows that Case 3 has damage to the upper bay tension brace results in the least capacity. Once the upper compression brace (1) buckles, there is no load path through the upper bay and, thus, the frame fails. Case 5, damage to the horizontal brace results in the least reduction in capacity. Based on the analyses, the most important member (in terms of producing the lowest DSR) is the upper tension brace in Case 3.
- *K1-braced Frame:* Six damaged cases were run for the K1-braced frame, the results of which are summarized in Table 4.2. The load-deflection curves of the damaged scenarios are shown in Figure 4.6. Case1, removal of the tension brace in the upper bay is the critical case for this bracing scheme, once the compression brace buckles, failure occurs abruptly. Case 3, damage to the upstream horizontal brace results in the least reduction in capacity. The most important member is the upper bay tension results in Case 1.
- *K2-braced Frames:* Six damaged cases were run for the K2-braced frame. The results of the analyses are summarized in Table 4.2. Figure 4.7 shows the load-deflection curves for the six damaged scenarios. The most important members are the tension and compression braces in Cases 1 and 2. Case 3, damage to the upstream horizontal results in the least reduction in capacity.
- *Single diagonal (compression)-braced Frame (SD1)*: Three damaged cases were run for the single diagonal (compression)-braced frame. Table 4.2 summarizes the DSRs of the damaged cases. The load deflection curves of the damaged frames are shown in Figure 4.8. The most important member is the compression brace in upper bay in Case 1.
- *Single diagonal (tension)-braced Frame (SD2):* Three damaged cases were run for the single diagonal (tension)-braced frame. Results are summarized in Table 4.2. Figure 4.9 shows the plot of load-deflection curves of the damaged scenarios. The most important member is the upper tension brace in Case 1.

A comparison of minimum, mean, and maximum damage strength ratios (DSR) for X-, K1-, K2-, and single diagonal (compression)- (SD1), and single diagonal (tension)- (SD2) bracing schemes is shown in Figure 4.10. The mean DSR of a particular frame is the mean of the damage strength ratios of the frame. Figure 4.10 shows that the X-braced frames are more damage tolerant than the other types of bracing schemes.

Figure 4.11 summarizes the most important and least important members for the five frames studied. The most important member is the member that if damaged will result in the largest decrease in platform capacity. The least important is the member that it damaged will result in lowest decrease in platform capacity. The figure demonstrates the importance of tension braces in terms of "robustness" in X, K1, K2 frames. Once the compression brace buckles, the load path through the bay is lost and the frame collapses.

While the study of the two-dimensional frames, provides a good understanding on the robustness of frames, there are other factors, which effect the member importance, including the sizing of members, out of plane bracing (3-D frames), torsion effects, etc.

As mentioned before, the frames were "optimally" designed for wave load only. In reality, the proportioning may not be so exact since some of the members may get even bigger once the jacket is checked for loadout, launch, transport, lifting and other loads. Another consideration would be that the waterline members typically have some increase in wall thickness corrosion allowance. These factors if considered might change the sizes of members used and hence the pushover results.

To demonstrate this, the X-brace frame was designed such that the upper bay vertical diagonals have the same sizes as those of the lower bay . Figure 4.12 shows the load displacement curves of the modified X-braced frame in the damaged and undamaged states. Case 4 has damage to the lower bay tension brace results in the least capacity. Once the lower compression brace (2) buckles, there is no load path through the lower bay and, thus, the frame fails. Case 5, damage to the horizontal brace, results in the least reduction in capacity. Based on the analyses, the most important member (in terms of producing the lowest DSR) is the upper tension brace in Case 4.

Figure 4.13 compares the member importance of the two X-braced frames used. While Figure 4.13 (a) shows the member importance for the X-braced frame used in Figure 4.5, Figure 4.13 (b) shows the member importance used in Figure 4.12. The most important member in the original frame is the upper bay tension brace while the most important member for the modified frame is the lower bay tension brace. Another factor that effects the member importance in a frame is the out-of-plane bracing. Results of a study by EQE [20, ****Simon take care of the reference***] are presented in Appendix B to demonstrate the effect of out-of-plane bracing, where the out of plane bracing changes the priority of members from upper vertical diagonals in the two-dimensional case to the lower bay members.

4.5 ROBUSTNESS OF THE FRAMES

Robustness is the measure of a structure's ability to sustain damage with a limited loss of reliability, i.e., the more damage tolerant the frame is, the more robust is the frame. The larger the Residual Resistance Factor (RRF), the more robust (damage tolerant) the platform. For any particular platform, as more and more members are damaged, the reserve strength of the platform, as measured by DSR, decreases. Robust structures experience a lesser decrease in the reserve strength of the damaged platform as compared to others.

The RRFs for the damaged cases described in Section 4.4 are summarized in Table 4.3. Figure 4.12 shows the comparison of minimum, mean, and maximum RRFs for the bracing schemes under study.

| Damage | Residual Resistance Factor (RRF) | | | | | | | | | | | | |
|--------|---|------|------|------|------|--|--|--|--|--|--|--|--|
| Case | Х | K1 | K2 | SD1 | SD2 | | | | | | | | |
| Case 1 | 0.80 | 0.18 | 0.17 | 0.16 | 0.17 | | | | | | | | |
| Case 2 | 0.83 | 0.18 | 0.17 | 0.35 | 0.37 | | | | | | | | |
| Case 3 | 0.48 | 0.62 | 0.70 | 0.51 | 0.54 | | | | | | | | |
| Case 4 | 0.56 | 0.58 | 0.55 | | | | | | | | | | |
| Case 5 | 0.97 | 0.58 | 0.53 | | | | | | | | | | |
| Case 6 | | 0.56 | 0.55 | | | | | | | | | | |

| | Table 4.3 | Performance | (RRF |) of damaged | frames |
|--|-----------|-------------|------|--------------|--------|
|--|-----------|-------------|------|--------------|--------|

RSR Lateral load at ultimate strength of the platform Design lateral load

DSR <u>Lateral load at Collapse (damaged)</u> Design lateral load

RRF <u>Lateral load at Collapse (damaged)</u> Lateral load at Collapse (undamaged)

Overall, the X-bracing scheme is the most robust design followed by the K-bracing schemes. In practice, many offshore platforms have diagonal bracing with braces in tension or compression for different horizontal parallel bays (see Figure 4.13), which can be more effective than the K-bracing scheme.

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Figure 4.1 (d) Single diagonal (compression) braced frame



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Figure 4.2 Load deflection curves for different designs of X-braced frames









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Figure 4.4 (e) Damaged cases of single diagonal (tension)-braced frame (one member removed at a time)



Figure 4.5 Load deflection curves for damaged X-braced frames



Figure 4.6 Load deflection curves for damaged K1-braced frames



Figure 4.7 Load deflection curves for damaged K2-braced frames



















Figure 4.13 Effect of member sizing on member importance

Note: I_i indicates the importance of member in terms of damage. I₁ is the most important (largest reduction in capacity if this member is damaged). F indicates the first member to yield in the pushover analysis of undamaged frame.





Figure 4.15 Diagonal-braced frame in an offshore platform

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N

5.0 DATASET EVALUATION

5.1 GENERAL REMARKS

The dataset consists of approximately 190 pushover analysis results on a total of 62 platforms as described in Section 2. These include 28 four-leg, 2 six-leg, 25 eight-leg, and 8 other platforms. A survey of the data set has shown that there are differences in platforms with respect to the number of legs, vintage, bracing scheme, grouting of leg/pile annulus, wave in deck and number of conductors.

In this study, results in either end-on or broadside directions were used to study the effects of the pushover analyses (see Figure 2.1). The longitudinal frames of the platform resist the end-on loading, while its transverse frames resist the broadside loading.

A grouping based on the framing scheme (including longitudinal and transverse frames) results in a breakdown of frames as shown in Table 5.1. In the two-dimensional analyses, single diagonal bracing schemes with braces in tension and compression were treated differently. In practice, however, they are typically found in combination on any particular frame. In addition, hydrodynamic loads often come from different directions. Therefore, for the dataset review, tension and compression diagonals are combined as a single case. The single diagonal is abbreviated as SD throughout this section.

| Number | | Bracing | Scheme | |
|---------|----|---------|--------|----|
| of Legs | Х | K1 | K2 | SD |
| <4 | 0 | 0 | 0 | 0 |
| 4 | 12 | 15 | 3 | 12 |
| 6 | 1 | 0 | 1 | 1 |
| 8 | 1 | 12 | 7 | 21 |
| >8 | 2 | 4 | 1 | 7 |

Table 5.1 Dataset: number of pushovers in each category

The platforms were grouped into X, K1, K2, and SD bracing schemes for four, six, eight, and more than eight leg platforms as shown in Tables 5.2 to 5.5 (see page 41). Within each bracing scheme, the platforms are sub-grouped based on the vintage and further divided based on the presence or absence of grouting in the leg/pile annulus. Once the platforms are grouped, other factors are identified, such as wave-in-deck and the number of conductors. The methodology used to group the platforms for an X-bracing scheme is shown in Figure 5.1.

The following sections study the effects of different parameters discussed in Section 3 such as bracing scheme, vintage, leg/pile annulus grouting, wave-in-deck, and conductors.

5.2 DATASET REVIEW METHODOLOGY

Evaluation of the datasets was done using three methods. While the first evaluation involves general observation, the latter two are statistical analyses of the data. The three methods are:

5.2.1 General trends

From the resulting dataset, graphical comparisons were developed for design base shear, ultimate capacity of platforms, and reserve strength ratio (scattered plots) versus water depth. These parameters were plotted for four-leg, six-leg, eight-leg, more than eight-leg, and all platforms. The purpose of this exercise was to identify the trends in dataset.

5.2.2 Statistical analysis

This task involved a statistical analysis of the dataset. Two approaches were used: 1) an evaluation of the minimum, mean, and maximum (MMM) values, and 2) an evaluation of the cumulative distribution function (CDF) for various related subsets of the platforms (e.g., 4 leg, 8 leg, grouted, ungrouted, etc.). Further background on the CDF approach is provided below.

The CDF was used to represent the characteristics of the reserve strengths of a group of platforms. The reserve strength ratio (RSR) of the platforms was treated as a random variable. A "lognormal" distribution was assumed to represent the probabilistic characteristics of the reserve strength in this study. A random variable X has a lognormal distribution if $\ln X$ (natural logarithm of X) is normal. The probability density function (PDF) is:

$$f_{X}(x) \quad \frac{1}{\sqrt{2\pi\zeta x}} \exp \begin{bmatrix} \frac{-1}{2} \left(\frac{\ln x - \lambda}{\zeta = z} \right)^{2} \\ \frac{-1}{2} \left(\frac{\ln x - \lambda}{\zeta = z} \right)^{2} \end{bmatrix}^{2} = 0 \le x < \infty = 0$$

Where $\lambda = E(\ln X)$ and $\zeta = \sqrt{Var(\ln X)}$ are, respectively, the mean and standard deviation of $\ln X$ where λ and ζ are the parameters of the distribution. The parameters of the lognormal distribution can be obtained from the mean and variance of the distribution as follows:

$$E(X) = \exp(\lambda + \frac{1}{2}\zeta^{2})$$

Var(X)
$$E^{2}(X)(e^{\zeta^{2}} - 1)$$

The cumulative distribution function (CDF) is given by:

$$F_X(x) \quad P(X \le x) \quad \int_0^x f_X(\xi) d\xi =$$

The coefficient of variation can be defined as the ratio of standard deviation to the mean of the dataset as

When a particular dataset has less than three data-points, a coefficient of variation (COV) of 30% was assured to calculate the standard deviation and the cumulative distribution function of the dataset.

Throughout the study, it was assumed that a common measure of performance of a particular dataset will be the median of the dataset. The median is the value of a random variable at which the values above and below it are equally probable, i.e., if x_m is the median of X, then

$$F_X(x_m) = 0.50$$

Where $F_X(x)$ is the Cumulative Distribution Function (CDF) X.

In addition to the median, the 5, 70, and 95-percent RSR s of the datasets were also used as performance measures. For example, for a particular CDF, RSR_{70} means that 70% of the RSRs in the dataset are below the RSR_{70} .

5.3 GENERAL TREND RESULTS

Numerous plots were made of all of the platforms as a function of water depth versus design base shear, ultimate strength and RSR. These comparisons showed several levels of correlation and are discussed in this section.

Figure 5.2 (a) shows water depth versus design base shear for all platforms in the dataset. The data is fairly random with a large amount of variation for a given water depth. Figure 5.2 (b) shows a similar set of data except that the 6-leg and >8 leg cases (of which there are few) have been eliminated. The larger data subsets of 4 leg and 8 leg platforms have been individually combined with no relation to framing scheme. Also shown are median curves through each set of data. The 8 leg platforms have higher overall design base shear than the 4 leg platforms, as expected. These curves are useful as a first estimate of the base shear for platforms of these configurations and at these water depths.

Figure 5.3 (a) shows water depth versus ultimate strength for all platforms. Figure 5.3 (b) shows the data binned in a similar manner as described above for base shear. The 8 leg platforms show higher capacity than the 4 leg platforms, as expected. The plot is again useful as an initial estimate of platform capacity as a function of water depth and number of legs.

Figure 5.4 (a) shows water depth versus RSR for all platforms. Figure 5.4 (b) shows the data binned in a similar manner as the prior cases. For RSR however, the 8 leg RSRs are unexpectedly below the 4 leg RSRs. This is thought to be due to the presence of a large number of "new design" CBC 4 leg platforms at around 100 ft. water depth which have high capacity since they are designed to modern API criteria (compared to the generally older vintage 8 leg platforms).

In addition, there is a cluster of low capacity, 1960's vintage in about 130-ft. water depth which tend to lower the 8 leg capacity curve. Figure 5.4(c) shows the curves with these platforms and the CBC platforms removed. In this case, with these "outlyers" taken out, the 8 leg platforms again have a larger RSR than the 4 leg platforms, as expected.

5.4 STATISTICAL ANALYSIS RESULTS

The MMMs and CDFs representing the probabilistic characteristics of reserve strength of all the datasets were used to compare the effect of the parameters described below for four, six, eight, and more than eight leg platforms. The parameters include:

- **Bracing scheme**: CDFs of data sets of four, six, eight, and more than eight leg platforms were computed for different bracing schemes. The further to the right the curve, the more efficient is the bracing scheme as shown by the example in Figure 5.5. Wherever possible, the effect of bracing schemes was studied by comparing CDFs of datasets from different bracing schemes for a particular vintage in order to provide a consistent comparison for bracing scheme only.
- *Vintage*: The effect of vintage was studied by comparing the CDFs of one particular bracing scheme for different vintages.

- *Leg/pile annulus grout*: To study the effect of grouting the leg/pile annulus, CDFs were computed for two datasets, grouted and ungrouted, for a particular vintage and bracing scheme.
- *Wave-in-deck*: The effect of wave-in-deck on the reserve strength of the platform was studied by comparing CDFs of two datasets having similar vintage and bracing characteristics, but differing in the wave-in-deck condition. The design wave inundates the deck in one dataset, but does not in the other.

5.4.1 Four-leg platforms

There are 42 pushover results in this category, including twelve X, fifteen K1, three K2, and, twelve SD frames. The effects of bracing scheme and vintage on the reserve strength of the platforms were studied using this dataset.

• Effect of Bracing-Scheme

Figures 5.5 and 5.6 illustrate the comparison of four-leg platforms with different bracing schemes. The datasets for X and SD frames contain platform cases which were designed as part of the API Consequence Based Criteria (CBC) study [13,14] in which the brace dimensions were optimized to arrive at an unity check of 1.0.

Figure 5.5 (a) compares the MMM RSRs of each dataset for platforms of all vintages grouped by framing type. The figure shows that the mean RSRs of SD and X frames are very close and are greater than those for K frames. Figure 5.5 (b) shows CDFs for different types of bracing schemes. The X-braced schemes are the most efficient (the CDF of X is the right most curve in Figure 5.5 (b)). Note that most of the X-braced CBC jackets in this category are optimized for the extreme storm strength. In practice, the platforms would likely have even higher RSRs once factors such as fatigue, load-out, transport, launch, installation, lifting and other items are incorporated into the design. These factors tend to increase the jacket member/joint size in several locations, which leads to an overall increase in jacket system capacity. Although these changes are not always substantial, they can be in the range of 15-20%.

Table 5.6 summarizes the RSRs having 5%, 50%, 70%, and 95% probability for X, K1, K2, and SD braced schemes of all vintages. X-braced frames have the highest RSRs with potential values greater than 4.0.

A comparison of different bracing schemes for a particular vintage, "1978-1993," is shown in Figures 5.6 (a) and 5.6 (b). Figure 5.6 (a) shows the comparison of MMM of the datasets. Figure 5.6 (b) compares the CDFs of those datasets. Again, the better performance of X frames as compared to SD and K frames is apparent.

• Effect of Vintage

Figures 5.7-5.10 show the comparison of platforms for different vintages, for X, SD, K1 and K2-braced platforms, respectively. Figures 5.7 (a), 5.8 (a), 5.9 (a), and 5.10 (a) show the comparison of MMM RSRs of the datasets. Figures 5.7 (b), 5.8 (b), 5.9 (b), and 5.10 (b) compare the CDFs for the same datasets, respectively. Note that the further to the right the curve, the more efficient are the platforms of that vintage.

These figures show that, in most cases, the performance of the platforms increases for platforms of later vintage. In the case of X and SD bracing schemes, platforms installed between 1978-1993 seem to perform better. However, this can be attributed to the design of

platforms from the "1999"CBC study where designs did not include fabrication, transportation, installation loads, etc. The platforms in the vintage group 1978-1993 from the API CBC study were designed to API 19th Edition, while platforms in the vintage group 1994-present from the API CBC study were designed to API 20th Edition.

5.4.2 Six-leg platforms

There are only two platforms with three types of frames (X, SD, K2) in this category. Figure 5.11 shows the CDFs for each of the three framing types. Figure 5.11 shows that the X-bracing scheme has a higher level of reserve strength compared to the K2-and SD frames. The SD and K2 are the end-on and broadside frames of the platform, respectively. Often, the capacity of the platform for the end-on direction pushover is expected to be better than that for the broadside direction.

Table 5.6 shows the 5, 50, 70, and 95 percentile RSRs for the above bracing schemes. The median for the X, SD, and K2 bracing schemes are 2.58, 0.96, and 1.59, respectively. These values demonstrate the better reserve strength characteristics of the X bracing scheme.

5.4.3 Eight-leg platforms

There are 41 pushover results in this category, including one X, twenty-one SD, twelve K1, and seven K2 frames. Since there are so many platforms of different configuration in this category there was a good opportunity to study the effects of other parameters (besides bracing and vintage), including grouting of the leg/pile annulus and wave-in-deck loading. These are described below:

• Effect of Bracing-Scheme

Figure 5.12 (a) shows the comparison of minimum, mean, and maximum RSRs for the datasets of X, SD, K1, and K2 bracing types. Figure 5.12 (b) shows the cumulative distribution functions (CDF) for these bracing schemes. These figures illustrate that the X braced platforms have greater reserve strength as compared to the other bracing schemes.

Table 5.6 summarizes the 5%, 50%, 70%, and 95% probability RSRs for X, SD, K1, and K2 frames. These values demonstrate that the reserve strength of X-braced platforms is more than that of other braced frames. The two-dimensional studies described in Section 4 have demonstrated that the X-braced frames offer alternative load paths to resist the loads.

• Effect of Vintage

Figures 5.13-5.14 show the effect of vintage on platforms with SD and K1 bracing schemes, respectively. Figures 5.13 (a) and 5.14 (a) show the comparison of MMM RSRs of the data sets. The CDFs for these datasets are compared in Figures 5.13 (b) and 5.14 (b), respectively. These figures illustrate that performance of the platforms improves for later vintage groups. As previously discussed, an improvement in design practices and technologies in recent years have contributed to the increase in platform reserve strength.

• Effect of Leg/Pile Annulus Grout

In order to study the effects of grouting, the group of eight-leg K1-braced platforms installed before 1964 has been divided into two subgroups based on whether the leg/pile annulus is grouted or not. Figure 5.15 (a) shows the comparison of MMM RSRs and Figure 5.15 (b) shows the CDFs of these datasets. These figures illustrate that leg/pile annulus grouting contributes to the increase in reserve strength of the platforms.

A quantitative comparison of platforms P38 and P41 is shown in Table 5.7 for pushovers in end on, diagonal, and broadside directions. While platform P40 has its leg/pile annuli filled with grout, P38 has ungrouted leg/pile annuli. For these platforms, leg/pile annulus grouting seems to have increased the reserve strength by approximately 10%.

• Effect of Wave-in-Deck

API 20th edition 100-year wave criteria has been used as a standard measure for the wave-indeck. In other words, for each platform, the wave-in-deck was determined based on whether the 100-year wave inundates the deck or not. The particular amount of wave-in-deck loads is based upon the amount of deck inundation based upon the comparison of the deck elevation and the wave crest elevation.

The effect of wave-in-deck was studied for single diagonal-braced platforms, designed before 1964. Figures 5.16 (a) and 5.16 (b) show the comparison of platforms with and without the wave inundation in the deck. Figure 5.16 (a) compares the MMM RSRs of the datasets and Figure 5.16 (b) shows their CDFs. These figures illustrate that the wave-in-deck loads result in decrease in RSR.

5.4.4 More than eight-leg platforms

This dataset consists of one 10 leg, one 12 leg, one 16 leg, four 8-leg with two 3-leg auxiliary platforms, and one 36-leg platform. There are fourteen pushover results in this category, including two X, seven SD, four K1, and one K2 frames.

Figure 5.17 (a) shows the comparison of MMM RSRs of the X, SD, K1, and K2 datasets. The CDFs for the above datasets are presented in Figure 5.17 (b). These figures illustrate that X-braced frames perform better than the other bracing-schemes.

Table 5.6 summarizes the 5%, 50%, 70%, and 95% probability RSRs for X, K1, and SD braced schemes for all vintages. These values demonstrate the better reserve strength of X braced platforms as compared to other bracing schemes. The RSRs shown for the >8 leg platforms are below those for platforms with a lower number of legs. This is contrary to the trend shown in a comparison of 4, 6, and 8 leg platforms where the RSR increases with the number of legs. This is because the particular dataset of >8 leg platforms consists of mostly older structures including 1950's vintage and unusual configurations (vertical legs) that result in lower RSRs.

| | Direction | 3roadside | 184 | 290 | | | | | | | | | | | | |
|---|--|---|--|---|--|---|--|--|---|--|--|---|--|-----------|-------|------|
| | RSR 1 | 0.7 I | 1.26 | 0.67 | | | | | | | | | | | | |
| e | on.] | 0 | 4 | 4 | | | | | | | | | | | | |
| Schem | VID C | es/ | - 20 | No | | | | | | | | | | | | |
| racing | VD V | 140 | 95 | 95 | | | | | | | | | | | | |
| K2 B | orm | 6 | 2 | 2 | | | | | | | | | | | | |
| | it Platf | s P4 | P2 | P2 | | | | | | | | | | | | |
| | e Grou | Yes | ° N | | | | | | | | | | | | | |
| | Vintag | <=64 | 26-82 | | | | | | | | | | | | | |
| | Direction | EndOn | Broadside | EndOn | Broadside | Broadside | Orthogonal | West | West | West | North | Orthogonal | EndOn | Broadside | East | s |
| | RSR | 0.83 | 1.88 | 1.23 | 0.76 | 0.55 | 0.99 | 2.1 | 1.38 | 1.2 | 1.51 | 1.45 | 1.66 | 1.02 | 1.7 | 2.31 |
| me | Con. | 0 | 0 | 0 | 0 | 10 | N/A | 12 | 22 | 28 | 28 | 28 | 10 | 10 | 7 | 7 |
| g Sche | WID | Yes | Yes | No | No | No | No | N/A | N/A | N/A | N/A | N/A | No | No | No | No |
| Bracin | WD | 170 | 170 | 144 | 144 | 103 | 61 | 180 | 180 | 180 | 180 | 61 | 182 | 182 | 164 | 164 |
| K1] | Platform | P31 | P31 | P42 | P42 | P07 | P25 | P26 A | P26 B | P26 C | P26 C | P50 | 60d | P09 | P57 | P57 |
| | Grout | Yes | | N0 | | Yes | Yes | | | | | | N0 | | Yes | |
| | Vintage | <=64 | | | | 64-69 | 69-77 | | | | | | | | 78-93 | |
| Π | ction | dOn | lside | uth | st | side | On | On | th | h | t | th | On | | | |
| | Dire | Ene | Broad | Sol | Ea | Broad | End | End | Sout | Sout | Eas | Sou | End | | | |
| e | RSR Dire | 1.4 En | 3.35 Broad | 2.02 Sot | 2.25 Ea | 1.75 Broad | 2.5 End | 2.05 End | 2.77 Sout | 1.64 Sout | 1.90 Eas | 2.50 Sou | 2.10 End | | | |
| Scheme | Con. RSR Dire | 0 1.4 En | 6 3.35 Broad | 6 2.02 Sot | 9 2.25 Ea | 6 1.75 Broad | 6 2.5 End | 6 2.05 End | 9 2.77 Sout | 6 1.64 Sout | 6 1.90 Eas | 6 2.50 Sou | 6 2.10 End | | | |
| tracing Scheme | WID Con. RSR Dire | Yes 0 1.4 En | No 6 3.35 Broad | No 6 2.02 Sot | N/A 9 2.25 Ea | No 6 1.75 Broad | No 6 2.5 End | No 6 2.05 End | N/A 9 2.77 Sour | N/A 6 1.64 Sout | No 6 1.90 Eas | No 6 2.50 Sou | No 6 2.10 End | | | |
| conal Bracing Scheme | WD WID Con. RSR Dire | 140 Yes 0 1.4 En | 219 No 6 3.35 Broad | 219 No 6 2.02 Sot | 161 N/A 9 2.25 Ea | 111 No 6 1.75 Broad | 111 No 6 2.5 End | 111 No 6 2.05 End | 161 N/A 9 2.77 Sour | 137 N/A 6 1.64 Sout | 111 No 6 1.90 Eas | 111 No 6 2.50 Sou | 111 No 6 2.10 End | | | |
| ingle Diagonal Bracing Scheme | Platform WD WID Con. RSR Dire | P49 140 Yes 0 1.4 En | P13 219 No 6 3.35 Broad | P13 219 No 6 2.02 Sou | P17 161 N/A 9 2.25 Ea | P05D 111 No 6 1.75 Broad | P05E 111 No 6 2.5 End | P05E 111 No 6 2.05 End | P17 161 N/A 9 2.77 Sour | P36 137 N/A 6 1.64 Sout | P05B 111 No 6 1.90 Eas | P05C 111 No 6 2.50 Sou | P05C 111 No 6 2.10 End | | | |
| Single Diagonal Bracing Scheme | Grout Platform WD WID Con. RSR Dire | Yes P49 140 Yes 0 1.4 En | Yes P13 219 No 6 3.35 Broad | P13 219 No 6 2.02 So | No P17 161 N/A 9 2.25 Ea | P05D 111 No 6 1.75 Broad | P05E 111 No 6 2.5 End | P05E 111 No 6 2.05 End | P17 161 N/A 9 2.77 Sour | P36 137 N/A 6 1.64 Sout | No P05B 111 No 6 1.90 Eas | P05C 111 No 6 2.50 Sou | P05C 111 No 6 2.10 End | | | |
| Single Diagonal Bracing Scheme | /intage Grout Platform WD WID Con. RSR Dire | 64-69 Yes P49 140 Yes 0 1.4 En | 78-93 Yes P13 219 No 6 3.35 Broad | P13 219 No 6 2.02 So | No P17 161 N/A 9 2.25 Ea | P05D 111 No 6 1.75 Broad | P05E 111 No 6 2.5 End | P05E 111 No 6 2.05 End | P17 161 N/A 9 2.77 Sour | P36 137 N/A 6 1.64 Sout | 94- No P05B 111 No 6 1.90 Eas | P05C 111 No 6 2.50 Sou | P05C 111 No 6 2.10 End | | | |
| Single Diagonal Bracing Scheme | Direction Vintage Grout Platform WD WID Con. RSR Dire | Broadside 64-69 Yes P49 140 Yes 0 1.4 En | East 78-93 Yes P13 219 No 6 3.35 Broad | South P13 219 No 6 2.02 South | South No P17 161 N/A 9 2.25 Ea | West P05D 111 No 6 1.75 Broad | South P05E 111 No 6 2.5 End | West P05E 111 No 6 2.05 End | East P17 161 N/A 9 2.77 Sour | South P36 137 N/A 6 1.64 Sout | East 94- No P05B 111 No 6 1.90 Eas | South P05C 111 No 6 2.50 Sou | South P05C 111 No 6 2.10 End | | | |
| Single Diagonal Bracing Scheme | RSR Direction Vintage Grout Platform WD WID Con. RSR Dire | 1.18 Broadside 64-69 Yes P49 140 Yes 0 1.4 En | 2.63 East 78-93 Yes P13 219 No 6 3.35 Broad | 3.69 South P13 219 No 6 2.02 South | 2.01 South No P17 161 N/A 9 2.25 Ea | 3.12 West P05D 111 No 6 1.75 Broad | 1.70 South P05E 111 No 6 2.5 End | 2.85 West P05E 111 No 6 2.05 End | 1.85 East P17 161 N/A 9 2.77 Sou | 2.85 South P36 137 N/A 6 1.64 Sout | 2.05 East 94- No P05B 111 No 6 1.90 Eas | 2.50 South P05C 111 No 6 2.50 Sou | 2.04 South P05C 111 No 6 2.10 End | | | |
| Single Diagonal Bracing Scheme | Con. RSR Direction Vintage Grout Platform WD WID Con. RSR Dire | 8 1.18 Broadside 64-69 Yes P49 140 Yes 0 1.4 En | 6 2.63 East 78-93 Yes P13 219 No 6 3.35 Broad | 6 3.69 South P13 219 No 6 2.02 South | 6 2.01 South No P17 161 N/A 9 2.25 Ea | 6 3.12 West P05D 111 No 6 1.75 Broad | 6 1.70 South P05E 111 No 6 2.5 End | 6 2.85 West P05E 111 No 6 2.05 End | 6 1.85 East P17 161 N/A 9 2.77 Sou | 6 2.85 South P36 137 N/A 6 1.64 Sout | 6 2.05 East 94- No P05B 111 No 6 1.90 Eas | 6 2.50 South P05C 111 No 6 2.50 Sou | 22 2.04 South P05C 111 No 6 2.10 End | | | |
| sheme Single Diagonal Bracing Scheme | WID Con. RSR Direction Vintage Grout Platform WD WID Con. RSR Dire | No 8 1.18 Broadside 64-69 Yes P49 140 Yes 0 1.4 En | No 6 2.63 East 78-93 Yes P13 219 No 6 3.35 Broad | No 6 3.69 South P13 219 No 6 2.02 South | No 6 2.01 South No P17 161 N/A 9 2.25 Ea | No 6 3.12 West P05D 111 No 6 1.75 Broad | No 6 1.70 South P05E 111 No 6 2.5 End | No 6 2.85 West P05E 111 No 6 2.05 End | No 6 1.85 East P17 161 N/A 9 2.77 Sout | No 6 2.85 South P36 137 N/A 6 1.64 South | No 6 2.05 East 94- No P05B 111 No 6 1.90 Eas | No 6 2.50 South P05C 111 No 6 2.50 Sou | No 22 2.04 South P05C 111 No 6 2.10 End | | | |
| acing Scheme Single Diagonal Bracing Scheme | WD WID Con. RSR Direction Vintage Grout Platform WD WID Con. RSR Dire | 160 No 8 1.18 Broadside 64-69 Yes P49 140 Yes 0 1.4 En | 111 No 6 2.63 East 78-93 Yes P13 219 No 6 3.35 Broad | 111 No 6 3.69 South P13 219 No 6 2.02 South | 111 No 6 2.01 South No P17 161 N/A 9 2.25 Ea | 111 No 6 3.12 West P05D 111 No 6 1.75 Broad | 111 No 6 1.70 South P05E 111 No 6 2.5 End | 111 No 6 2.85 West P05E 111 No 6 2.05 End | III No 6 1.85 East PI7 161 N/A 9 2.77 Sourt | 111 No 6 2.85 South P36 137 N/A 6 1.64 Sout | 111 No 6 2.05 East 94- No P05B 111 No 6 1.90 Eas | 111 No 6 2.50 South P05C 111 No 6 2.50 Sou | 475.72 No 22 2.04 South P05C 111 No 6 2.10 End | | | |
| X Bracing Scheme Single Diagonal Bracing Scheme | Platform WD WID Con. RSR Direction Vintage Grout Platform WD WID Con. RSR Dire | P08 160 No 8 1.18 Broadside 64-69 Yes P49 140 Yes 0 1.4 En | P02 111 No 6 2.63 East 78-93 Yes P13 219 No 6 3.35 Broad | P02 111 No 6 3.69 South P13 219 No 6 2.02 South | P04 111 No 6 2.01 South No P17 161 N/A 9 2.25 Ea | P04 111 No 6 3.12 West P05D 111 No 6 1.75 Broad | P05A 111 No 6 1.70 South P05A 111 No 6 2.5 End | P05A 111 No 6 2.85 West P05E 111 No 6 2.05 End | P01 111 No 6 1.85 East P17 161 N/A 9 2.77 Sou | P01 111 No 6 2.85 South P36 137 N/A 6 1.64 South | P03 111 No 6 2.05 East 94 No P05B 111 No 6 1.90 Eas | P03 111 No 6 2.50 South | P56 475.72 No 22 2.04 South P05C 111 No 6 2.10 End | | | |
| X Bracing Scheme Single Diagonal Bracing Scheme | Grout Platform WD WID Con. RSR Direction Vintage Grout Platform WD WID Con. RSR Direction | No P08 160 No 8 1.18 Broadside 64-69 Yes P49 140 Yes 0 1.4 En | No P02 111 No 6 2.63 East 78-93 Yes P13 219 No 6 3.35 Broad | P02 111 No 6 3.69 South P13 219 No 6 2.02 Sou | P04 111 No 6 2.01 South No P17 161 N/A 9 2.25 Ea | P04 111 No 6 3.12 West P05D 111 No 6 1.75 Broad | P05A 111 No 6 1.70 South P05E 111 No 6 2.5 End | P05A 111 No 6 2.85 West P05E 111 No 6 2.05 End | No P01 111 No 6 1.85 East P17 161 N/A 9 2.77 Source | P01 111 No 6 2.85 South P36 137 N/A 6 1.64 Sout | P03 111 No 6 2.05 East 94- No P05B 111 No 6 1.90 Eas | P03 111 No 6 2.50 South P05C 111 No 6 2.50 South | Yes P56 475.72 No 22 2.04 South P05C 111 No 6 2.10 End | | | |

Table 5.2 Four leg platforms

Table 5.3 Six leg platforms

| | | | | |
|-----------|-----------|-----------|---|------|
| | Direction | Broadside | | |
| | RSR | 1.03 | | |
| ne | On. | | | |
| Schei | D OI | | | _ |
| acing | D M | 30 | | _ |
| 2 Br | m W | 13 | | |
| ž | Platfor | P35 | | |
| | Grout | Yes | | |
| | Vintage | 64-69 | | |
| | Direction | | | |
| | RSR | | | |
| ne | Con. | | | |
| Scher | VID (| | | |
| acing | V D | | | |
| 1 Bra | m V | | | |
| K | Platfor | | | |
| | Grout | | | |
| | Vintage | | | |
| | Direction | EndOn | | |
| eme | RSR | 1.69 | | |
| g Sche | Con | | | |
| racin | WID | | | |
| nal B | WD | 130 | | |
| gle Diago | atform | P35 | | |
| Sin | Grout P | Yes | - | |
| | intage (| 64-69 | | |
| | sction V | dOn | | |
| | R Dire | 2 En | | |
| | N. RS | 2.7. | | |
| heme | WID Co | | | |
| acing Sc. | MD | 118 | | |
| X Br. | Platform | P51 | | |
| | Grout | No | | |
| | Vintage | 64-69 | | |

WD - Water Depth WID - Wave in Deck Con. - Conductors RSR - Reserve Strength Ratio NA - Not Available

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| | | XBr | acing . | Schem | 9 | | | | | Single Diago | nal Br. | acing S | cheme | | | | K | 1 Braci | ng Sche | me | | | | | K | 2 Braci | ng Sche | me | | |
|--------|-------|----------|---------|-------|------|------|-----------|---------|-------|--------------|---------|---------|---------|-----------|------------|---------|---------|---------|----------|------|------|-----------|---------|-------|----------|---------|---------|------|------|-----------|
| intage | Grout | Platform | WD | WIL | Con. | RSR | Direction | Vintage | Grout | Platform | WD | WID C | on. RS | R Directi | on Vintage | e Grout | Platfor | n WE | MID | Con. | RSR | Direction | Vintage | Grout | Platform | WD | WID | Con. | RSR | Direction |
| NA | No | P27 | 310 | No | 10 | 2.80 | Broadside | <64 | Yes | P28 | 140 | No | 10 0.7 | 5 EndO | n <64 | Yes | P28 | 140 | No No | 10 | 0.56 | Broadside | 64-69 | Yes | P34 | 176 | Yes | 8 | 1.04 | Broadside |
| | | | | | | | | | | P33 | 145 | Yes | 8 0.9 | 5 EndO | Ę | | P33 | 145 | : Yes | ~ | 0.82 | Broadside | | | P37 | 107 | Νo | 12 | 2.48 | Broadside |
| | | | | | | | | | | P40 | 180 | Yes | 8 1.3 | 2 EndO | 5 | | P40 | 180 | Yes 1 | ~ | 0.93 | Broadside | | | P48 | 141 | No | 16 | 1.48 | Broadside |
| | | | | | | | | 1 | | P47 | 140 | No | 0 1.1 | 1 EndO | | | P44 | 61 | N/A | N/A | 1.05 | Broadside | | | P55 | 184 | No | 14 | 2.19 | Broadside |
| | | | | | | | | | °N | P38 | 137 | Yes | 8 0.8 | 4 EndO | 5 | | P47 | 140 | °N N | 0 | 0.86 | Broadside | 64-69 | °N | P52 | 160 | οN | Ξ | 0.94 | EndOn |
| | | | | | | | | | | P45 | 140 | Yes | 8 0.9 | 1 EndO | 5 | °N N | P38 | 137 | ' Yes | ~ | 0.85 | Broadside | 69-77 | Yes | P11 | 263 | No | 18 | 1.26 | Broadside |
| | | | | | | | | | | P46 | 140 | Yes | 16 0.6 | 6 EndO | Ę | | P45 | 140 | Yes | 8 | 0.84 | EndOn | 78-93 | N0 | 614 | 125 | N/A | N/A | 5.01 | Broadside |
| | | | | | | | | 64-69 | Yes | P34 | 176 | Yes | 8 0.9 | 1 EndO | <u>ہ</u> | | P46 | 140 | Yes | 16 | 0.54 | Broadside | | | | | | | | |
| | | | | | | | | | | P37 | 107 | °N N | 12 1.3 | 1 EndO | n 64-69 | °N N | P18 | 247 | °Z | 14 | 1.50 | Broadside | | | | | | | | |
| | | | | | | | | | | P48 | 141 | νo | 16 0.7 | 0 EndO | 5 | | P41 | 137 | N/A | 0 | 1.31 | Broadside | | | | | | | | |
| | | | | | | | | 1 | | P55 | 184 | No | 14 1.6 | 0 EndO | n 69-77 | T Yes | P12 | 300 | ٥N م | 24 | 3.24 | Broadside | | | | | | | | |
| | | | | | | | | 1 | No | P18 | 247 | No | 14 1.1 | 1 EndO | u | No | P10 | 255 | No : | 21 | 1.39 | Broadside | | | | | | | | |
| | | | | | | | | 1 | ΝA | P41 | 137 | N/A | 0 0.6 | 4 EndO | ۲ ۲ | | | _ | | | | | | | | | | | | |
| | | | | | | | | - | | P52 | 160 | °N | 11 1.8 | 0 EndO | 5 | | | | | | | | | | | | | | | |
| | | | | | | | | | ΝA | P53 | 103 | N/A | 4/A 0.6 | 0 Broadsi | de | | | | | | | | | | | | | | | |
| | | | | | | | | 69-77 | Yes | P11 | 263 | No | 18 1.1 | 2 EndO | c . | | | | | | | | | | | | | | | |
| | | | | | | | | | No | P10 | 255 | No | 21 1.3 | 1 EndO | - | | | | | | | | | | | | | | | |
| | | | | | | | | 78-93 | Yes | P54 | 211 | No | 24 1.5 | 5 EndO | L L | | | | | | | | | | | | | | | |
| | | | | | | | | | | P54 | 211 | No | 24 2.2 | 5 Broadsi | de | | | | | | | | | | | | | | | |
| | | | | | | | | | No | P19 | 125 | N/A 1 | 4/A 4.2 | 0 EndO | c . | | | | | | | | | | | | | | | |
| | | | | | | | | NA | No | P27 | 310 | No | 10 2.5 | 0 EndO | c | | | | | | | | | | | | | | | |
| | | | | | | | | | | | ſ | ┝ | | | | | | | | | | | | | | | | | | |

Table 5.4 Eight leg platforms

Table 5.5 Platforms with more than eight legs

| | | X Bra | tcing St | cheme | | | | | S | ingle Diag | onal Br | acing | Schem | ۔ ا | | | | K11 | Bracin | g Sche | me | | | | | K2 B | racing | Schen | Je | | |
|---------|-------|----------|----------|-------|------|------|-----------|---------|-------|------------|---------|-------|-------|--------|-----------|---------|-------|----------|--------|--------|------|------|-----------|---------|----------|--------|--------|-------|-----|------|-----------|
| Vintage | Grout | Platform | ΜD | WID | Con. | RSR | Direction | Vintage | Grout | Platform | ΜD | WID | Con. | RSR | Direction | Vintage | Grout | Platform | Μ | MID | Con. | RSR | Direction | Vintage | Grout Pl | atform | MD 1 | VID (| 0n. | RSR | Direction |
| <64 | Yes | P14 | 88 | No | 14 | 2.68 | EndOn | <64 | Yes | P29 | 187 | Yes | 16 | 0.52 | End On | <64 | Yes | P29 | 187 | Yes | 16 | 0.85 | Broadside | 64-69 | Yes | P32 | 168 | Yes | 0 | 1.83 | Broadside |
| | | P14 | 88 | No | 14 | 1.94 | Broadside | | | P39 | 128 | Yes | 16 | 1.13 | End On | | | P39 | 128 | Yes | 12 | 0.77 | Broadside | | | | | | | | |
| | | | | | | | | | N0 | P30 | 160 | Yes | 6 | 0.52 | End On | | N0 | P30 | 160 | Yes | 6 | 1.27 | Broadside | | | | | | | | |
| | | | | | | | | | | P43 | 139 | Yes | N/A | 0.56 | EndOn | | | P43 | 139 | Yes | N/A | 1.06 | Broadside | | | | | | | | |
| | | | | | | | | | | P23 | 37 | °2 | N/A | 1.47 | End On | | | | | | | | | | | | | | | | |
| | | | | | | | | | _ | P23 | 37 | No | N/A | 1.99 | Broadside | | | | | | | | | | | | | | | | |
| | | | | | | | | 64-69 | Yes | P32 | 168 | Yes | 0 | 0.99 | End On | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

WD - Water Depth WID - Wave in Deck Con. - Conductors RSR - Reserve Strength Ratio NA - Not Available

| Bracing | 5% | 50% | 70% | 95% |
|---------|---------------------------------------|----------------|------|------|
| | | 4 Leg Platform | ns | |
| X | 1.35 | 2.27 | 2.67 | 3.74 |
| K1 | 0.65 | 1.28 | 1.57 | 2.43 |
| K2 | 0.47 | 0.84 | 1.01 | 1.52 |
| SD | 1.44 | 2.13 | 2.41 | 3.12 |
| | · · · · · · · · · · · · · · · · · · · | 6 Leg Platform | ns | |
| X | 1.58 | 2.58 | 3.01 | 4.20 |
| K1 | | | | |
| K2 | 0.58 | 0.96 | 1.13 | 1.58 |
| SD | 0.97 | 1.59 | 1.56 | 2.60 |
| | | 8 Leg Platform | ns | |
| Х | 1.63 | 2.65 | 3.10 | 4.32 |
| K1 | 0.46 | 1.02 | 1.31 | 2.22 |
| K2 | 0.65 | 1.74 | 2.36 | 4.47 |
| SD | 0.52 | 1.23 | 1.61 | 2.87 |
| | | >8 Leg Platfor | ms | |
| X | 1.34 | 2.18 | 2.56 | 3.56 |
| K1 | 0.67 | 0.97 | 1.09 | 1.39 |
| K2 | | | | |
| SD | 0.38 | 0.90 | 1.20 | 2.15 |

Table 5.6 Performance of platforms as measured by RSR
(Probability RSR <= Value shown)</th>

Table 5.7 Effect of grouting

| | | RSR | |
|--------------------|--------|----------|-----------|
| Platform | End-On | Diagonal | Broadside |
| P38 | 0.84 | 0.77 | 0.85 |
| P40 | 1.32 | 0.88 | 0.93 |
| Relative (P40/P38) | 1.57 | 1.14 | 1.09 |





Figure 5.1 Demonstration of grouping of platforms for X-braced 4 leg platforms



Figure 5.2 (a) Water depth vs design base shear - all platforms










Figure 5.3 (b) Water depth vs ultimate strength - select platforms







Figure 5.4 (b) Water depth vs RSR – select platforms



















Figure 5.6 (b) Cumulative distribution function for different bracing schemes four leg platforms (vintage 1978-1993)



Figure 5.7 (a) Comparison of vintages four leg platforms (X-braced frames)



Figure 5.7 (b) Cumulative distribution function for different vintages four leg platforms (X-braced frames)



Figure 5.8 (a) Comparison of vintages four leg platforms (SD-braced frames)



Figure 5.8 (b) Cumulative distribution function for different vintages four leg platforms (SD-braced frames)



Figure 5.9 (a) Comparison of vintages four leg platforms (K1-braced frame)















Figure 5.11 Cumulative distribution functions for different bracing schemes six leg platforms



















Figure 5.14 (a) Comparison of vintage eight leg platforms (K1-braced frames)



























Figure 5.17 (b) Cumulative distribution functions for platforms with more than eight legs

6.0 INSPECTION PLANNING

Underwater inspection, along with structural assessment and data management, are an integral part of structural integrity management of an offshore platform. During the lifetime of an offshore structure, it may be exposed to a number of hazards including extreme storms, seismic loads, ship impact, dropped objects, degradation due to fatigue, corrosion, and fracture. The purpose of inspection is to reveal possible deterioration and damage caused by these events. The significant costs of the underwater inspection make it important to prioritize and limit inspections, thus making the development of an effective inspection plan and strategy essential.

The damage tolerance of a platform plays an important role in determining its risk. As defined in previous sections, robustness is a measure of the damage tolerance – the more robust, the more that a platform is tolerant to damage. Thus, robust structures may not need as much inspection as other structures, thus allocating inspection resources to platforms with higher risk.

The issues addressed in this project, such as number of legs, bracing schemes, etc., are representative of the structure configuration only and reflect the *likelihood of failure*. Inspections should also consider the use of the structure (drilling, production, quarters, central hub platform) and the associated *consequence of failure*. For example, an unmanned wellhead platform versus a manned production platform. It is more critical to ensure integrity of the manned facility and as such, in some cases, it would receive priority for inspection. A true "risk based" platform inspection planning process considers both the likelihood of failure and the consequence of failure. EQE worked with BP Amoco to develop such an approach as described in Reference 12.

While developing a complete inspection plan based on the robustness is not within the scope of this study, the influence of the key factors studied in this project can help focus inspections to the most critical platforms and the most critical areas of these platforms. Further work is needed, as explained in Section 7, to fully develop a true risk based inspection plan. However, several of the key findings of can be used to help develop inspection plans. These are summarized as follows:

- Number of legs: Eight- and six- leg platforms are more redundant than four- and three leg platforms, and therefore more damage tolerant. This was shown in numerous evaluations of the dataset. While preparing an inspection plan, eight- and six-leg platforms can be considered more robust, thereby prioritizing the inspections on four- and three-leg platforms. However, this must be combined with the platform bracing scheme and vintage as described below. For example, a newer 4 leg, X braced platform may have more robustness than an older 8 leg K braced platform.
- Bracing scheme: The 2D ultimate strength analyses described in Section 4 clearly demonstrated that X-braced frames are more robust than the K- and diagonal-braced frames due to the availability of alternate load paths. This robustness of X bracing was also shown in the statistical comparisons of the dataset. The advantages of robustness of an X-braced frame should be considered when developing the inspection strategy. This includes extending the interval of periodic underwater inspections or demonstrating that an immediate repair is not essential in the event of damage being found.

Gebara et al. [2] further highlight the advantages of X-braced structures some of which include, ease of fabrications, capability of X-braced structure to redistribute load without

a sudden drop in strength, and the capability of X-braced structures to sustain damage with a smaller increase in probability of failure compared to other framing patterns.

It should be noted that the horizontal braces in the vertical frames are relatively less important in X-braced frames than in other braced frames. Table 4.3 in Section 4, shows that when the horizontals of an X-braced frame are damaged, there is 3% reduction in RSR compared to a 50-65% decrease for the other framing schemes, with the K-bracing schemes having the largest reductions. Hence, while inspecting the horizontals in X-braced structures may not be crucial, it might be vital to inspect the horizontals in other framed structures

- *Vintage*: As shown by evaluation of the dataset, the performance of platforms improves in platforms of more recent. The vintage of the platform reflects the platform characteristics as design practices have evolved over the time. Newer platforms are designed to better standards and practices (joint cans, higher deck height/air gap, overlap of joints, etc.) and hence more robust than older platforms. Thus, older platforms in the same fleet should have a higher focus for inspection. However, if the previous inspections reveal that a newer platform has a track record of damage such as fatigue cracking in the conductor bays, perhaps because of same initial design or fabrication flaw, this particular platform will require additional and more regular inspection (see last bullet item below).
- *Leg/Pile grouting*: As discussed in Section 3 and the dataset evaluation in Section 5, grouting of the leg/pile annulus increases the capacity of the joints of the braces framing into the leg and thus increases the overall strength of the platforms. Platforms without leg grouting may be more susceptible to joint damage, which can decrease platform capacity.

Wave-in-deck and other design defects or platform damage: Some older platforms have lowset decks that may be impacted by design waves. There were several platforms of this type in the dataset and these platforms clearly showed lower ultimate strength and RSRs compared to platforms with higher decks. This type of problem can be considered a "design flaw." Likewise, other platform may have a fabrication/installation defect such as a dent or crack. Platforms with these characteristics will likely have lower ultimate strength and RSRs than similar undamaged platforms, and may require more focus for inspection.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 TWO-DIMENSIONAL FRAME ANALYSES

The pushover analyses of the 2D damaged and undamaged frames illustrates the advantages of X-bracing over K-bracing and diagonal bracing. X-bracing offers redundancy and alternate load paths to resist the loading once the compression brace buckles, that enhances the overall platform system strength. This was shown by the comparison of the RRF (Residual Resistance Factor, computed as damaged capacity divided by undamaged capacity) for each of the bracing schemes. The lowest RRF for the X-braced structure was about 50%, whereas the diagonal and K-braced structures had RRFs in the range of 15%. This clearly demonstrates that platforms based upon X-braced schemes have "significant" more reserve capacity in the damaged state than platforms with the other bracing schemes –perhaps as much as 2-3 times.

This work also developed a ranking of platform members in terms of robustness. This "member importance" can be used as a general guideline for identifying critical members for inspection on platforms of different framing schemes. However, as pointed out in Section 6, there are many factors involved in inspection planning, such as 3-D effects, member sizing, consequence of failure of the platform and existing damages that should be taken into account in any inspection program. Therefore, this information should always be used in combination with other pertinent data.

7.2 DATASET EVALUATION

A dataset was developed in Excel spreadsheet format of the platform information and analyses results for 65 platforms and 190 individual pushover ultimate strength analyses. This data was then evaluated for trends and other characteristics that may be useful in understanding the performance of platforms at ultimate capacity and for inspection planning. Several of the key findings are as follows:

- = *Platform vintage*. Newer platforms perform better than older platforms. This is an expected result given the advances in design codes and was confirmed by this study.
- *Number of legs.* The more legs the better in terms of reserve strength ratio (RSR). While RSR is not an explicit measure of robustness (in terms of damage tolerance), a higher RSR does indicate a lower reduction in capacity given the loss or damage to any one platform member.
- *Framing scheme*. The dataset evaluation showed similar results as the 2D analysis in terms of framing, with the X braced framing in the dataset of 3D platforms analyses also performing the best.
- *Other issues*. Grouting of the leg-pile annulus (which increases platform capacity, particularly joints) and situations where the design wave impacts the deck (older platforms with low set decks, which decreases capacity) were shown to be other issues where there was a consistent trend.

This information is also useful for inspection planning, particularly for determining the priority for inspecting specific platforms in a fleet. For example, older platforms with K or single diagonal framing that are susceptible to wave-in-deck loading during the design event are of higher priority than new platforms of X braced design.

7.3 RECOMMENDED ADDITIONAL WORK

This project has provided an opportunity to put together the various pushover analyses performed in the past and study the effect of different parameters on the ultimate strength of the platforms. In addition, the effect of bracing schemes on strength and robustness was studied quantitatively by conducting pushover analyses of 2D frames with different bracing schemes. The following recommendations are made to extend this information and to develop a further understanding on the robustness of the platforms and the development of inspection strategies:

- *Extend the dataset to include additional platforms.* The dataset used in this study consisted of a variety of platform types and configurations from around the world. As in the case of any dataset, additional information can improve the quality of results. Also, much of the data used in this project is related to simply framed older Gulf of Mexico platforms, which allows a first pass evaluation of platform performance using straightforward configuration issues (simple framing X or K, no skirt piles, etc.). However, there are a variety of other platform configurations used offshore, particularly in the North Sea. This recommended effort would involve gathering of new platform ultimate capacity information, perhaps from HSE files, and additional dataset evaluations. EQE or the HSE may also be able to obtain ultimate strength analyses from several operators, to input to the dataset perhaps for in-kind exchange of some portion of the results of the project.
- Extend the results to more complex framing schemes. This project focused on generally . simple framing schemes - a necessary step in understanding platform robustness. However, other than shallow Gulf of Mexico platforms, more complex framing schemes are typically used offshore. This includes a combination of X, K, and single diagonal vertical bracing schemes all used in one structure, as well as, more exotic and complex 3D framing. In addition, there are other complexities that exist such as a variety of plan bracing schemes (X, diamond, diagonal, etc.), congested joints, balloon joints, and skirt pile framing. This recommended effort would involve a combination of additional 2-D (and perhaps 3D) ultimate strength analysis and additional data gathering and evaluation related to new platforms added to the dataset. While the two-dimensional frames study as a part of this project provided a good understanding of robustness, a study of the factors including, the effect of member sizing, out-of-plane bracing (3 D frames study) would provide further understanding of platform robustness. The focus would be to understand some of the more complex framing schemes that are typically found in North Sea platforms.
- Develop a risk-based inspection planning process. The work developed by this project provides an initial basis for prioritized inspections. However, as previously mentioned, there are numerous factors that must also be accounted for when developing inspection plans, for example, the consequence of failure of a platform (e.g., manned vs. unmanned), results of previous inspections and any known damage. These factors are mentioned in the current ISO and API inspection guidelines. EQE worked with BP Amoco to develop a risk-based underwater inspection prioritization process using various rules that were based upon experience and expert judgment. EQE has also developed underwater inspection philosophies in the recent Flooded Member Detection JIP. The information developed in the project described in this document, along with

these other studies, provides a good opportunity to develop a risk-based inspection approach that can be used by the HSE to prioritize efforts associated with inspection planning and review.

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APPENDIX A

ELASTIC ANALYSES OF TWO-DIMENSIONAL FRAMES

- X-BRACED FRAME
- K1 (K POINTED DOWN)-BRACED FRAME
- K2 (K POINTED UP)-BRACED FRAME
- SINGLE DIAGONAL (COMPRESSION)-BRACED FRAME
- SINGLE DIAGONAL (TENSION)-BRACED FRAME

X-BRACED FRAME



Figure A.1 X-braced Frame – Member Sizes



Figure A.2 X-braced Frame – Unity Checks

K1 (K POINTED DOWN)-BRACED FRAME



Figure A.3 K1-braced Frame – Member Sizes



Figure A.4 K1-braced Frame – Unity Checks

K2 (K POINTED UP)-BRACED FRAME



Figure A.5 K2-braced Frame – Member Sizes



Figure A.6 K2-braced Frame – Unity Checks

SINGLE DIAGONAL (COMPRESSION)-BRACED FRAME



Figure A.7 Single Diagonal (Compression) – Member Sizes



Figure A.8 Single Diagonal (Compression) – Unity Checks

SINGLE DIAGONAL (TENSION) BRACED FRAME



Figure A.9 Single Diagonal (Tension) – Member Sizes



Figure A.10 Single Diagonal (Tension) – Unity Checks

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Effect of platform robustness on inspection planning