ANALYSIS DEFECT CIS 7 & QLASSIC ACEPTABLE SCORE (2015–2018)

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PREFACE

To develop and drive a merit-based culture in the construction industry, it is important to ensure that the quality of contractors and construction works meet a minimum standard. The quality assessment namely Quality Assessment System in Construction (QLASSIC) is a system or method to ensure and evaluate the workmanship quality of a building construction work based on Construction Industry Standard (CIS 7:2014). QLASSIC enables the quality of workmanship between construction projects to be objectively compared through a scoring system. Hence, this system assesses contractor workmanship and broader quality assurance for both contractors and overall construction projects.

This document entitle **"Analysis Defect CIS 7 & QLASSIC Acceptable Score (2015 – 2018)"** produced by the Construction Industry Development Board (CIDB) will be used as the primary reference and baseline QLASSIC data report for the construction industry as facts and figures to evaluate and monitor the trend of the quality construction projects. This report aimed to analysed defect data based on QLASSIC assessment data from year 2015 to 2018 and to recommend Acceptable Score to be used as minimum scoring in quality assessment.

The CIDB wish to express their gratitude and appreciation to the construction industry who participated in QLASSIC Certification Scheme thus providing platform to assess and conduct this project. This report hopefully can increase the use and adoption of the system thus enhance the overall quality improvement in construction projects that benefit to the end user.

Quality Division,
Technology Development Sector,
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EDITORIAL

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EXECUTIVE SUMMARY

Construction industry is one of the industries that commonly known contributes significantly to negative impact in terms of material, workmanship and quality of building. To overcome this issue, the Malaysian Construction Industry Development Board (CIDB) has implemented a quality assessment system using a point monitoring checklist called Quality Assessment System in Construction (QLASSIC). QLASSIC is an effective tool to provide a criterion quality workmanship for contractors, hence allowing the building occupier getting the most quality building product from the developers. This initiative is aligned with the national quality and safety aspiration as stated under the Construction Industry Transformation Programme (CITP) 2016-2020.

This study outlined two (2) main objectives which are to analyse the defect group of CIS 7 and to set up the acceptable score for QLASSIC scoring. This study also analyses the number of assessments by state and category from year 2015 until 2018. Conclusion and recommendation were drawn at the end of the study.

The findings show that the main defect group contributed to the defects is Finishing and Floor. Other defect groups which are also contributed to the defects are Material & Damages, Drain, External Wall and Joints & Gaps. The defect group of Finishing involved five (5) elements which are Floor, Internal Wall, Ceiling, External Wall and Roof while for the defect group Floor involved four (4) elements which are Playground, Court, Link-way / Shelter and Car Park / Car Porch.

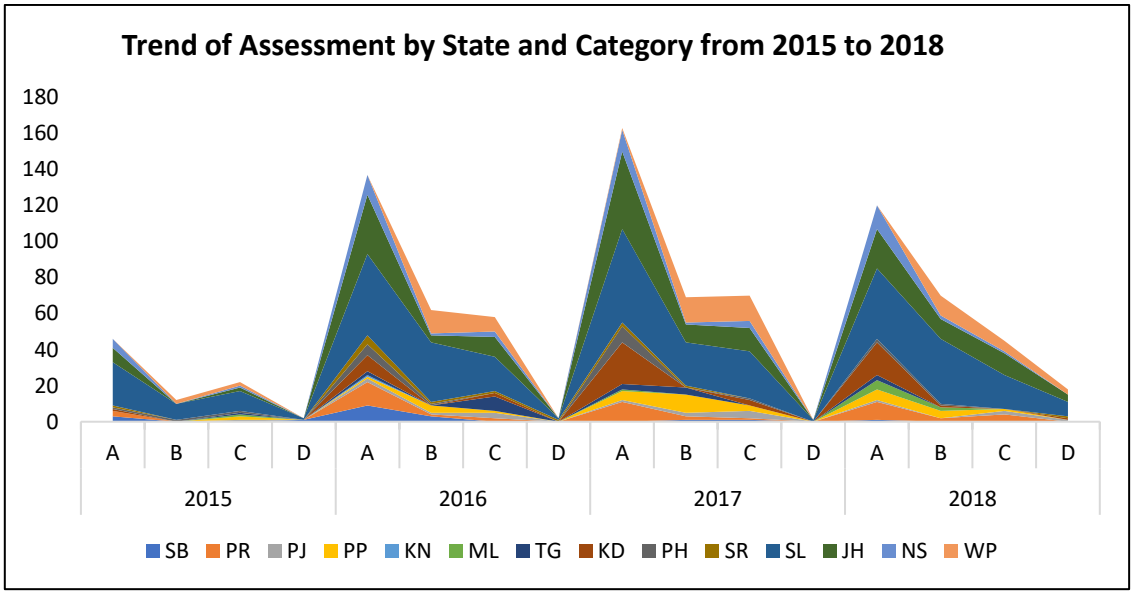
Element	Defect Group (Highest)			
	2015	2016	2017	2018
Floor	Finishing	Finishing	Finishing	Jointing
Internal Wall	Finishing	Finishing	Finishing	Finishing
Ceiling	Finishing	Finishing	Finishing	Finishing
Door	Material & Damages	Material & Damages	Material & Damages	Material & Damages
Window	Material & Damages	Material & Damages	Material & Damages	Material & Damages
Internal Fixtures	Material & Damages	Material & Damages	Functionality	Material & Damages
Roof	Finishing	Finishing	Finishing	Finishing
External Wall	Finishing	Finishing	Finishing	Finishing
Apron & Perimeter Drain	Drain	Drain	Drain	Drain
Car Park / Car Porch	Basic M&E Fittings	-	Floor	Floor

Element	Defect Group (Highest)			
	2015	2016	2017	2018
Link-way / Shelter	Floor	Floor	Floor	Floor
External Drain	Drain	Drain	Drain	Drain
Roadwork & Car Park on the ground	Road Markings	Road Surface	Road Surface	Kerbs
Footpath & Turfing	Footpath 1	Footpath 1	Footpath 1	Footpath 1
Playground	Floor	Floor	Floor	Floor
Court	Floor 2	Floor 1	Floor 2	Signages
Fencing & Gate	Fence 1	Fence 1	Fence 1	Fence 1
Swimming Pool	Overflow Drain	Pool deck Overflow Drain	Pool deck	Fixtures
Electrical Substation	External Wall	External Wall	External Wall	External Wall
Guard House	Roof	-	-	External Wall
Bin Centre	External Wall	-	-	External Wall
Basic M&E Fittings	Joints & Gaps	Joints & Gaps	Joints & Gaps	Joints & Gaps

The analysis of acceptable for QLASSIC scoring shows the mean score of QLASSIC is 70 score and above for all years from 2015 until 2018. Majority of the highest mean score are from Category A followed by Category B. The overall mean score is 73 score. Thus, the baseline of the QLASSIC score shall be fall between 70 – 75 to increase the implementation of QLASSIC to the Malaysian construction industry.

Year	Category	Mean Score	Total Mean Score
2015	A	74	73
	B	70	
	C	73	
	D	81	
2016	A	72	72
	B	72	
	C	71	
	D	65	
2017	A	72	72
	B	74	
	C	72	
	D	77	
2018	A	75	74
	B	74	
	C	69	
	D	75	

The number of assessments by state and category from year 2015 until 2018 shows that Selangor recorded the highest number of assessments followed by Johor. Kelantan shows the least number of assessments. Category A and Category B is the most assessed category and 2017 recoded the highest number of assessments followed by 2016.



From the findings, it is indicated that the defect group that should be tackle of are Finishing and Floor. The contractor should increase the workmanship of the finishing especially for the elements Floor, Internal Wall, Ceiling, External Wall and Roof. Besides that, the contractor shall recheck and validated the quality of the material especially for Floor element.

CONTENTS

LIST OF ABBREVIATION

CASC	Construction Assessment Centre
CIDB	Construction Industry Development Board
CIS	Construction Industry Standard
CITP	Construction Industry Transformation Programme
CREAM	Construction Research Institute of Malaysia
KPI	Key Performance Indicator
PPR	People's Housing Program
M&E	Mechanical and Electrical
QAS	Quality Assessment System
QLASSIC	Quality Assessment System in Construction

CHAPTER 1: INTRODUCTION

1.1 What is QLASSIC?

Quality in the construction industry plays a significant role in guaranteeing the personal satisfaction of the occupants. As such, quality within the construction industry should be continuously improved thereby contributing to a high rate of growth and development in the industry and the Malaysian economy. Therefore, it is crucial to continuously build the quality management system or quality assessment system within the building and construction industry to improve the quality of work. In Malaysia, the Quality Assessment System (QAS) in the construction industry, is called (QLASSIC), developed by the Construction Industry Development Board (CIDB).

According to the CIDB, QLASSIC is a system or method used to measure and assess the quality of construction work based on the Construction Industry Standard (CIS 7:2014), similar to guidelines used for construction projects in achieving quality outcomes. Principally, the motivation behind QLASSIC is to improve the quality of the construction industry in Malaysia. QLASSIC was first introduced into Malaysia in 2006 to enable the quality of workmanship between construction project to be objectively compared through a scoring system. The categories of buildings that can be accessed using QLASSIC include landed housing, stratified housing, building for public use such as offices and schools, in addition to distinctive buildings such as hospitals and airports, etc.

QLASSIC establishes the standard on the quality of workmanship for different construction components of building construction work. Marks are awarded based on the level of compliance against the standard (CIS 7:2014) that the workmanship conforms to, which are summarised to compute the QLASSIC Score (%) for the construction work. Given it is impractical to assess all components in a construction project, the assessment via QLASSIC utilises a sampling method for this task. Before conducting the assessment, a delegate from the Construction Assessment Centre (CASC), a unit under Construction Research Institute of Malaysia (CREAM) that manages the QLASSIC assessment activities, will decide upon the nature and size of the components or areas (i.e. samples) to be assessed. The samples must reflect the activities and work that has been undertaken throughout the project chosen from the drawings and plans of the applicable construction project. All areas in the construction project must be accessible for the assessment.

1.2 Scope of QLASSIC

Four principal components are assessed for building construction. The outline for each component is shown in Table 1. A QLASSIC assessment will normally be undertaken following completion of building construction work or beforehand during the completion of the project.

Table 1.1: Summary of building construction components assessed via QLASSIC

Component	Details
1. Structural works*	The structural integrity of the building is of great importance since the cost of any failure and repairs is significant. The assessment of structural works comprises of: i. Site inspection of reinforced concrete, structural steel, and prestressed concrete structures during construction. ii. Test results of the compressive strength of concrete and tensile strength of steel reinforcement. iii. Non-destructive testing of the uniformity and cover of hardened concrete.
2. Architectural works	Architectural works mainly deal with finishes. This is when the quality and standard of workmanship are most visible. Architectural works comprise of: 1. Floors 2. Internal walls 3. Ceilings 4. Doors 5. Windows 6. Fixtures 7. External walls 8. Aprons 9. Perimeter drains 10. Structure car parks 11. Car porches.
3. Mechanical and Electrical (M&E) works	The quality of M&E works is most important given its increasingly high-cost proportion to the project and impact on the performance of a building. The assessment addresses: 1. Electrical works* 2. Air-conditioning and mechanical* ventilation works (ACMV)* 3. Fire protection works* 4. Sanitary and plumbing works* 5. Basic M&E fittings.
4. External works	External works address the general external work elements in building construction, such as: 1. Link-way/shelter 2. External Drain 3. Roadwork 4. Car park on the ground 5. Footpath

Component	Details
	6. Turfing 7. Playground 8. Court 9. Gate 10. Fence 11. Swimming Pool 12. Electrical substation 13. Guardhouse 14. Bin centre.

Reference: Construction Industry Standard (CIS7:2014).

*Components that are not covered in the current practice; the score will be pro-rated.

1.3 Development of QLASSIC

QLASSIC was first introduced into Malaysia by the CIDB in 2006 The first standard adopted in the industry as the Construction Industry Standard (CIS 7:2006) as mentioned earlier. In 2018, the first revision of the Construction Industry Standard 7 was introduced, referred to as the Construction Industry Standard (CIS 7:2014) which continues to be used.

The CIS 7:2014 is separated into four principal components. The assessment of the workmanship is carried out based on the components as established under the standard where points are awarded if the workmanship complies to the standard. These points are then summarised, giving a total quality (TQ) score called the QLASSIC Score for the building.

The components assessed include:

a) Structural works

The structural integrity of the building is of utmost importance, given the cost of failure and repairs will be high. The assessment of structural works comprises:

i) Site inspection of formwork, steel reinforcement, prefabricated or pre-cast elements, etc. during construction;

ii) Laboratory testing on compressive strength of concrete and tensile strength of steel reinforcement; and

iii) Non-destructive testing of the uniformity and the cover of hardened concrete.

b) Architectural works

Architectural works deal mainly with the finishes, which is where the quality and standards of workmanship are most visible. Architectural works include floors, internal walls, ceilings, doors and windows, fixtures and fittings, external walls, roofs, driveways, porches, and aprons.

c) Mechanical and Electrical (M&E) works

The quality of M & E works is important, given its increasingly high-cost proportion to the project and impact on the performance of a building. Generally, the assessment addresses electrical works, air-conditioning and mechanical ventilation works (ACMV), fire protection works, sanitary and plumbing works, lifts, escalators, and other basic M & E fittings.

d) External works

External works cover elements in building construction such as link-ways, shelters, drains, road works, car parks, footpaths, turfing, playgrounds, gates and fences, swimming pools, hardscapes, and electrical substation(s). Under the Construction Industry Standard (CIS), the weightage for structural, architectural, M&E, and external works are allocated in accordance with four categories of buildings. The weightage system, which is aimed to achieve the objective of the QLASSIC assessment represents the overall quality of a building. Moreover, it is a compromise between the cost proportions of four components in various buildings and aesthetic considerations. The QLASSIC score for a building is computed as the sum of points awarded to the four components in each category of a building.

1.4 QLASSIC in the Construction Industry Transformation Programme (CITP)

The CITP was launched on 10th September 2015 having four main thrusts that include Quality, Safety and Professionalism, Environmental Sustainability, Productivity, and Internationalisation. Under CITP, it proposes the improvement of quality standards by increasing the implementation of quality assessments via QLASSIC. QLASSIC assesses the workmanship of contractors and broader quality assurance for building construction, which has led to improvements in the quality of both contractors

and overall construction work. Six key performance indicators (KPIs) are established to achieve the aim of QLASSIC in the Malaysian construction industry. The KPIs are depicted in Table 1.2:

Table 1.2: KPIs for QLASSIC

Year	KPI
2018	500 accredited QLASSIC assessors produced.
2019	i. Minimum of one qualified QLASSIC assessor for every G7 contractor undertaking building projects. ii. Twenty (20) key developers adopted the guideline for a minimum QLASSIC score of 70 in their contractual requirement for a residential project.
2020	I. More than 50% of public building projects completed annually by G7 contractors need to achieve a minimum QLASSIC score of 70. II. More than 50% of private residential projects having a contract sum exceeding RM 10M completed annually need to achieve a minimum QLASSIC score of 70. III. Minimum of one Site Supervisory Staff (SSS) for public building projects trained on QLASSIC.

1.5 Importance of QLASSIC in the undertake Malaysian Construction Industry

A study undertaken by the Construction Research Institute of Malaysia (CREAM) in 2018 revealed that the quality of interior and exterior construction work became one of the main factors related to residential satisfaction towards the People's Housing Program (PPR) for housing. The recommendation made by the researchers (CREAM) suggested that there is a need to establish policy and regulation to check on the quality of interior and exterior construction to overcome the issue of quality of the building. Thus, QLASSIC us used to address this issue.

1.6 Objective of the Study

The objectives of the study are two-fold:

i. To analyse the defect group of CIS 7; and
ii. To establish a baseline for an acceptable score for QLASSIC scoring.

CHAPTER 2: CURRENT STATUS OF QLASSIC ACHIEVEMENT

The concern related to the quality of workmanship in the construction industry has been one of the main aspects raised by stakeholders, as mandated under CIDB Act 520. As such, significant efforts have been progressed under various initiatives to educate the industry on the importance of quality construction.

2.1. QLASSIC Industry Achievement in 2018

a) QLASSIC Assessment trend from 2015 to 2018

The number of QLASSIC projects between 2015 and 2018 totalled 887, as shown in Figure 2.1, involving Categories A, B, C and D. In 2015, 82 projects had undergone QLASSIC assessment comprising of 45 projects in Category A, 11 projects in category B, 24 projects in Category C and two projects in Category D. In 2016, there were 248 projects assessed by QLASSIC; Category A (136 projects), Category B (47 projects), Category C (63 projects) and Category D (2 projects). Since 2015, the implementation of QLASSIC in building projects has incrementally grown each year. Figure 2.1 illustrates that in 2018, the trend was slightly lower compared to 2017 by around 8.6% with 314 projects, while the number of projects implemented remained above the annual targeted project projects set at 300 projects per year (Figure 2.2).

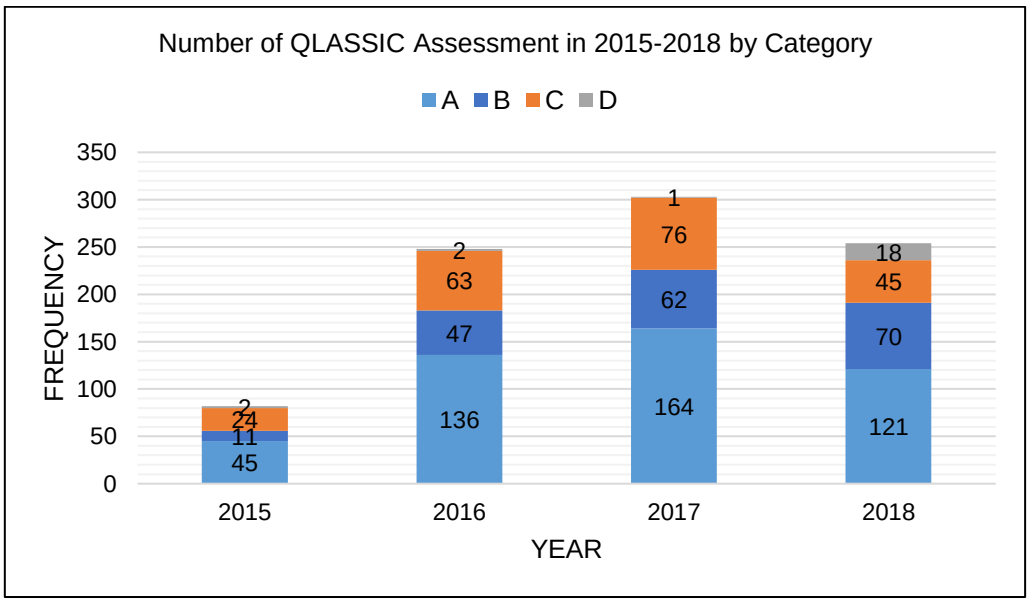


Figure 2.1 Number of QLASSIC Assessments in 2015-2018.

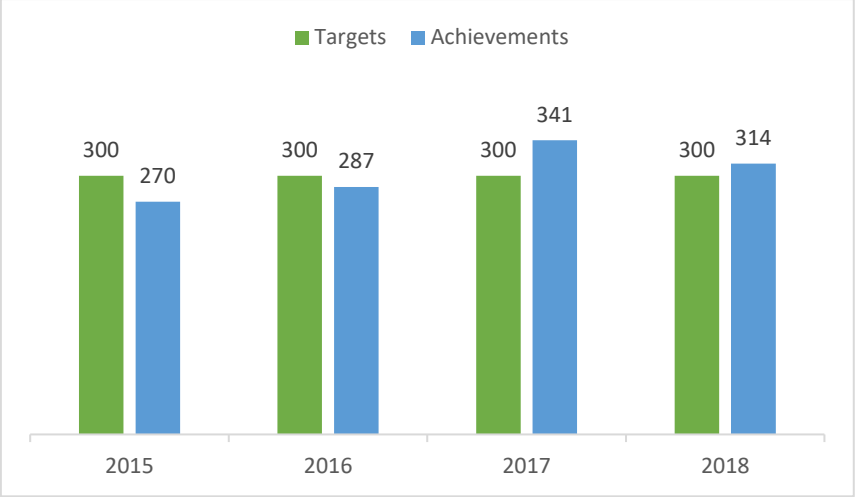


Figure 2.2: Number of projects assessed vs targeted projects (2015-2018).

b) Registration for building projects from 2015 to 2018

- 2015: 6% (Registration for 2015: 4500 building projects).
- 2016: 9.8% (Registration for 2016: 2928 building projects).
- 2017: 15% (Registration for 2017: 2280 building projects).
- 2018: 14.5% (Registration for 2018: 2165 building projects).

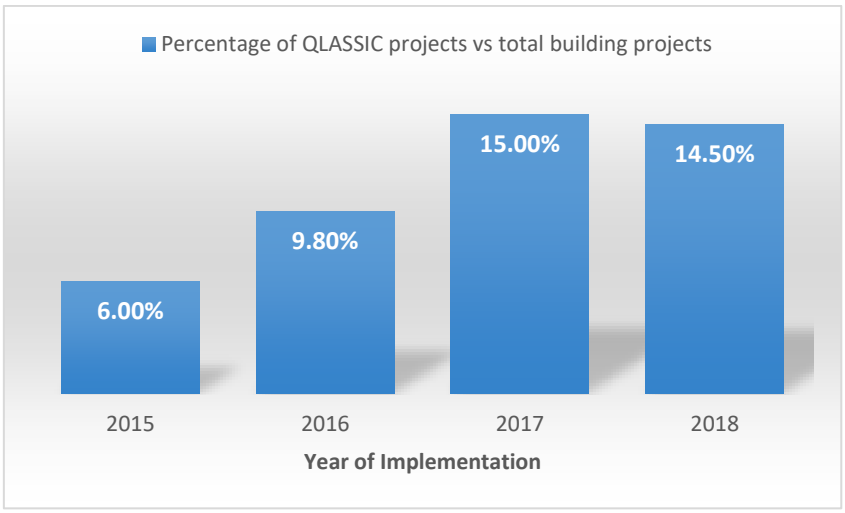


Figure 2.3: Percentage of QLASSIC Implementations in 2015-2018.

c) Average Scores for QLASSIC from 2015 to 2018

Figure 2.4 shows that the average QLASSIC scores between 2015 and 2018 lingered between 72% and 74% with the lowest score recorded in 2017, and the highest average score was in 2018 at 74%. This indicates that contractors have improved over these years in delivering better quality workmanship in their projects.

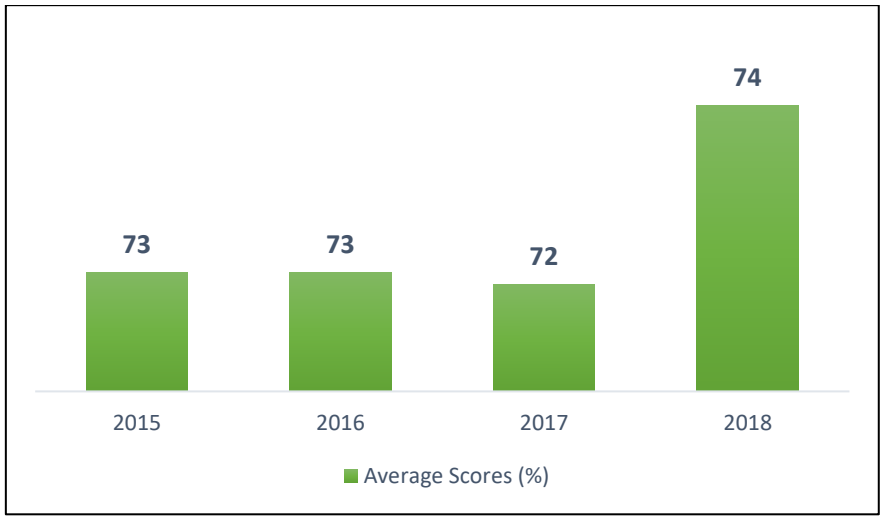


Figure 2.4: Average QLASSIC scores (2015-2018).

d) Statistics for 2018 according to each category (A, B, C and D) for a total of 314 projects

From a total of 314 projects that underwent the QLASSIC assessment, as shown in Figure 2.5, in 2018, Category A – landed housing represented the largest proportion compared to the remaining categories at 49.6%, followed by Category B – stratified housing at 27.4%, Category C – public buildings and category D – special public buildings settled at 16.6% and 6.4% respectively.

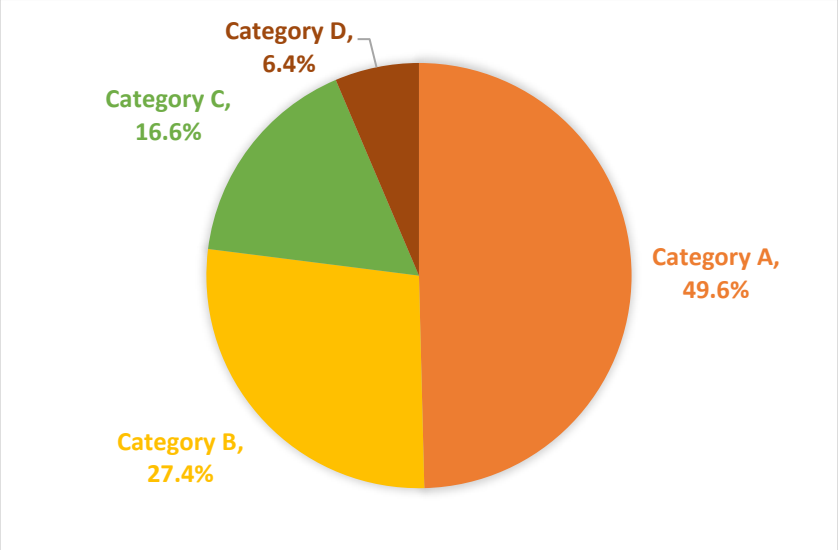


Figure 2.5: The distribution number of projects assessed in 2018 (by Building Category).

e) Scores obtained for projects assessed in 2018

For 2018, it showed promising statistics, as more than 75% of projects had implemented QLASSIC at their site, with scores ranging between 60% and 79%. Around 62 from 314 projects obtained scores exceeding 80% while only a minority (2.22%) from the sum of projects in 2018 scored less than 59% (Figure 2.6).

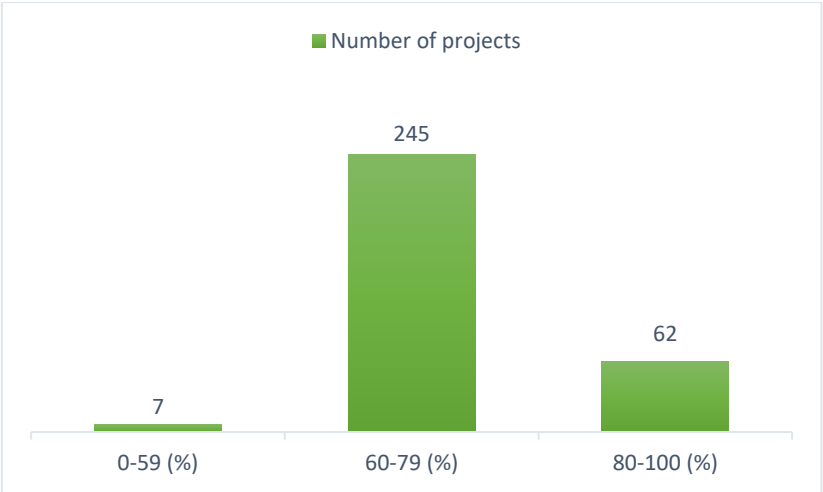


Figure 2.6: Number of projects for each score range.

g) Regional Classification

As shown in Figure 2.7, the largest contributor relating to the sum projects that had implemented QLASSIC was from Greater Klang Valley (Selangor and Kuala Lumpur) with 152 projects (48%) from the total sum of projects using the QLASSIC methodology in Malaysia. The state of Johor was second with 59 projects from a total of 314 projects in 2018.

Accordingly, it is suggested that more campaigns and activities should be undertaken in other states to increase the adoption of QLASSIC as the level of awareness of QLASSIC is shown to be more prominent in urban areas.

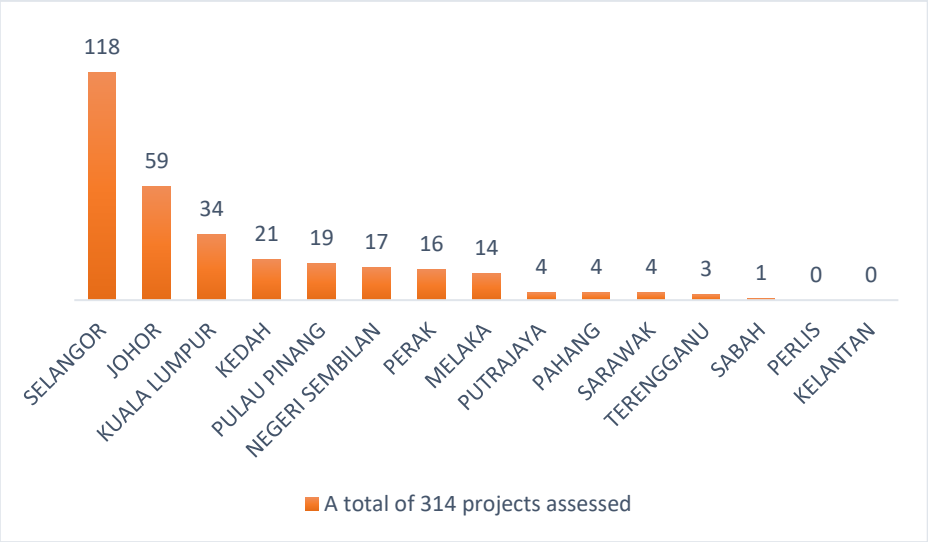


Figure 2.7: Distribution of QLASSIC Implementation by each state in 2018.

2.2. QLASSIC Excellence Award

A celebration day for QLASSIC high scorers, "QLASSIC Day 2019" was held to recognise developers and contractors who had achieved high scores and achievements in 2018. The event was officiated by the Minister of Works, YB Tuan Baru Bian, where he applauded the good work of high scorers and encouraged the industry to increase the pace to achieve better results in future.

The highest QLASSIC score was for Saujana Duta Phase 2L Seremban, Negeri Sembilan, owned by the Seremban Two Holding Sdn. Bhd., co-constructed by the contractors, Timbunan Bakti Construction Sdn. Bhd., and architect, Design Collective Architecture Network Sdn. Bhd.

The QLASSIC Excellence Awards for assessments undertaken in 2018 were divided to the following categories:

- Highest Achievement QLASSIC Award 2019.
- High QLASSIC Achievement Award 2019 (Landed Residential Development).
- High QLASSIC Achievement Award 2019 (High Rise Residential Development).
- High QLASSIC Achievement Award 2019 (Non-Residential Development).
- QLASSIC Special Appreciation given to Government Projects 2019.

A complete list of receivers of the awards is listed in Appendix 1: QLASSIC Excellence Awards 2019.

CHAPTER 3: METHODOLOGY

3.1. Data Collection Method

The data received from the CIDB represented the secondary data of this study. CREAM received the file from CIDB for the period between 2015 and 2018 and analysed the results via Microsoft Excel. The sum of the defect group was also incorporated into MS Excel. The final output of the results depicted the highest defect group during the QLASSIC assessment stage.

The QLASSIC score benchmarking data received were analysed using MS Excel with the output representing the total mean score for each category (Categories A, B, C and D) and the maximum score for benchmarking. The formula for calculating the mean is expressed as follows:

$$\bar{x} = \frac{\sum x}{N}$$

$\sum x$ = the sum of x

N = number of data

CHAPTER 4: DATA ANALYSIS

4.1. Analysis on Defect Group

A. 2015

Figure 4.1 shows the total number of locations assessed for 2015. The majority of the assessed locations is represented as the Principal (P), followed by Service (S) and Circulation ©.

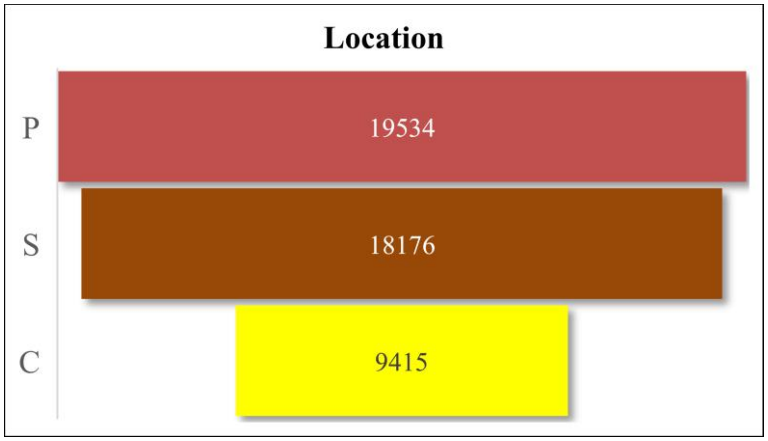


Figure 4.1: Total Number of Assessed Locations (2015).

Figure 4.2 shows the percentage of compliance for defect group, Floor. The highest percentage of compliance is 99.2% for Alignment & Evenness, followed by Crack & Damages (95.5%). The lowest percentage of compliance is Finishing at 19.8%.

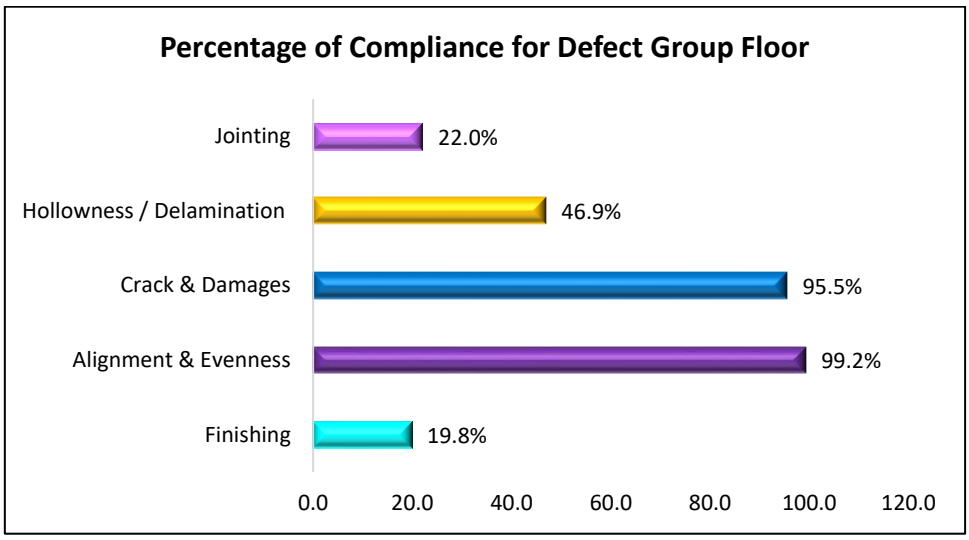


Figure 4.2: Percentage of Compliance for Defect Group Floor (2015).

Figure 4.3 shows the percentage of compliance for the defect group, Internal Wall. The highest percentage of compliance is 92.2% for Alignment & Evenness, followed by Crack & Damages (88.6%). The lowest percentage of compliance is for Finishing at 15.6%.

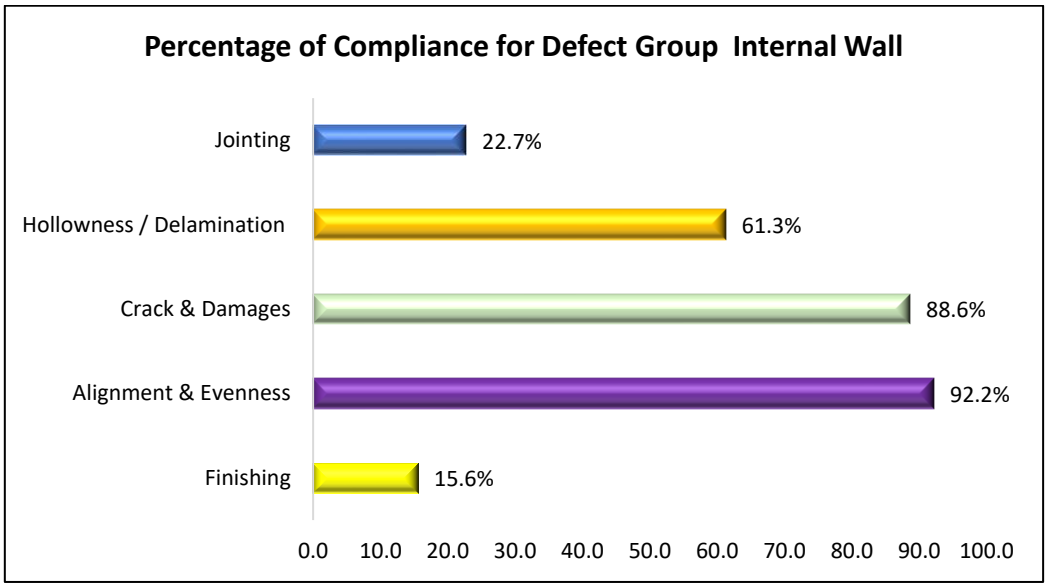


Figure 4.3: Percentage of Compliance for Defect Group Internal Wall (2015).

Figure 4.4 shows the percentage of compliance for the defect group, Ceiling. The highest percentage of compliance is 97.0% for Alignment & Evenness, followed by Hollowness/Delamination (95.7%). The lowest percentage of compliance is for Finishing at 19.1%.

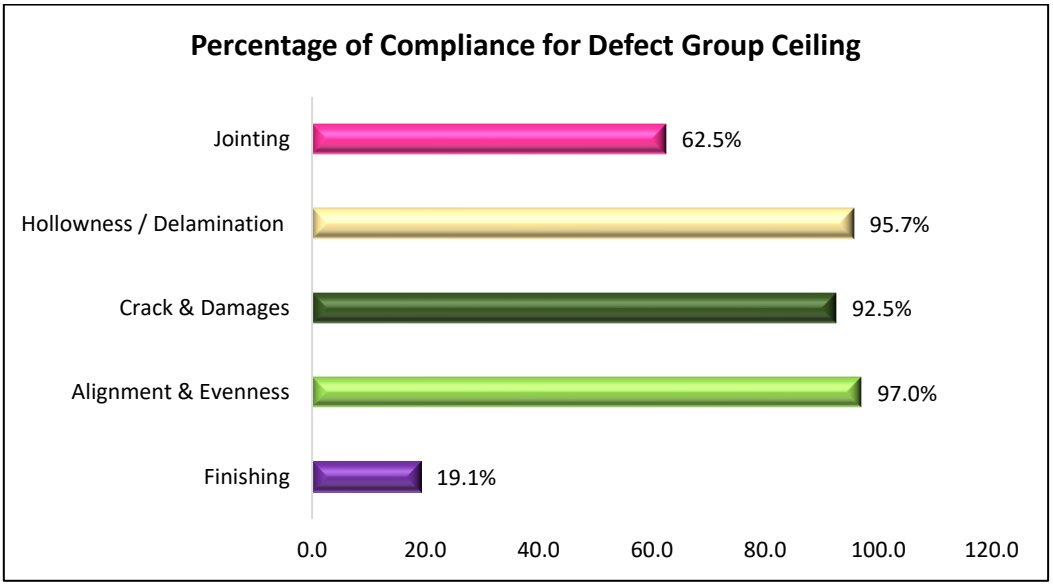


Figure 4.4: Percentage of Compliance for Defect Group Ceiling (2015).

Figure 4.5 shows the percentage of compliance for the defect group, Door. The highest percentage of compliance is 98.9% for Functionality, followed by Alignment & Evenness (94.4%). The lowest percentage of compliance is for Material & Damages with 24.6%.

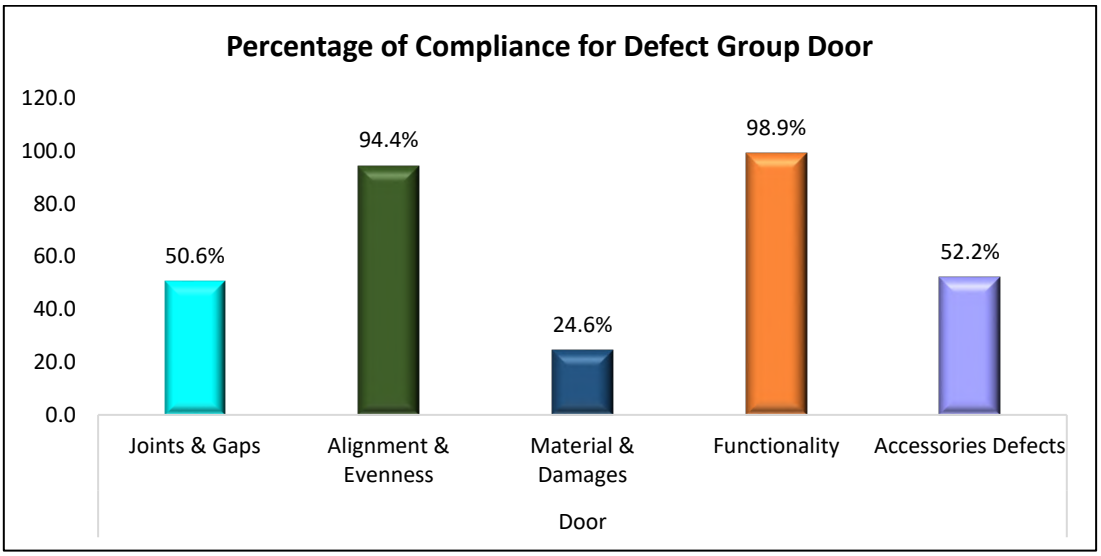


Figure 4.5: Percentage of Compliance for Defect Group Door (2015).

Figure 4.6 shows the percentage of compliance for the defect group, Window. The highest percentage of compliance is 98.3% for Functionality, followed by Alignment & Evenness (96.6%). The lowest percentage of compliance is for Material & Damages with 28.9%.

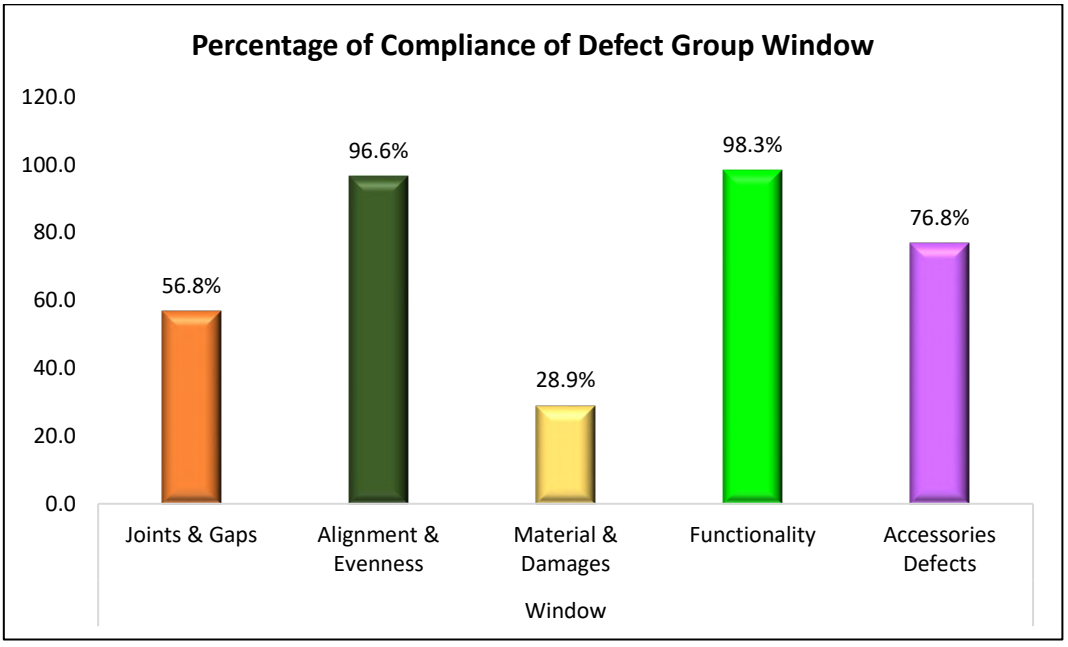


Figure 4.6: Percentage of Compliance for Defect Group Window (2015).

Figure 4.7 shows the percentage of compliance for defect group, Internal Fixtures. The highest percentage of compliance is 99.0% for Functionality, followed by Alignment & Evenness (98.5%). The lowest percentage of compliance is for Material & Damages with 63.9%.

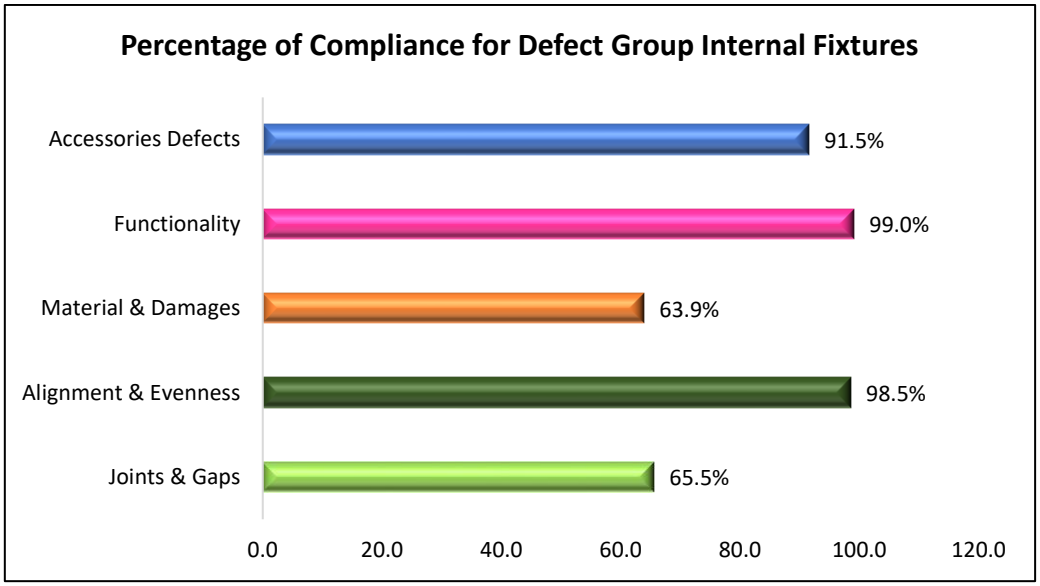


Figure 4.7: Percentage of Compliance for Defect Group Internal Fixtures (2015).

Figure 4.8 shows the percentage of compliance for defect group, Roof. The highest percentage of compliance is 98.1% for Rough/Uneven/Falls, followed by Chokage/Ponding (95.1%). The lowest percentage of compliance is for Finishing at 40.2%.

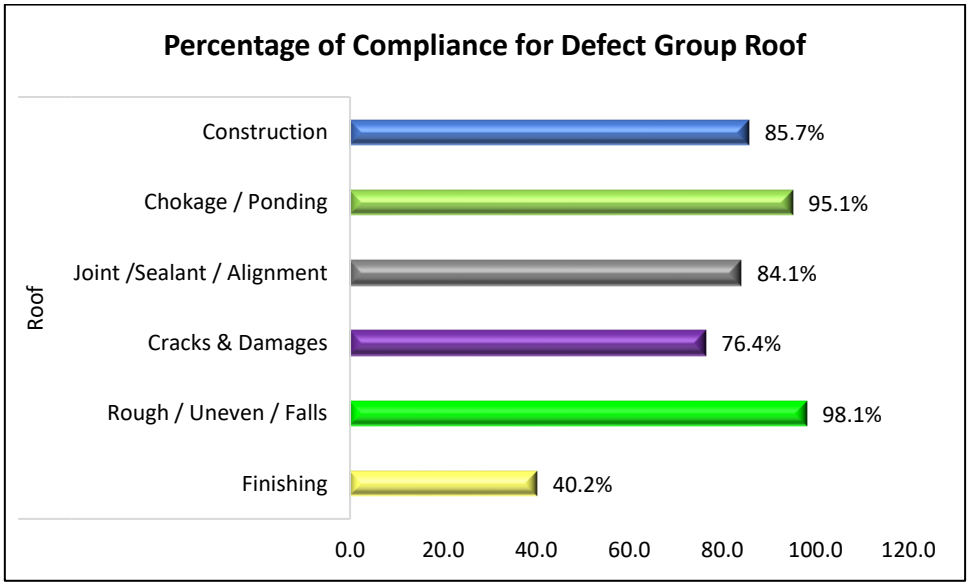


Figure 4.8: Percentage of Compliance for Defect Group Roof (2015).

Figure 4.9 shows the percentage of compliance for defect group, External Wall. The highest percentage of compliance is 89.3% for Jointing, followed by Crack & Damages (86.0%). The lowest percentage of compliance is for Finishing at 37.3%.

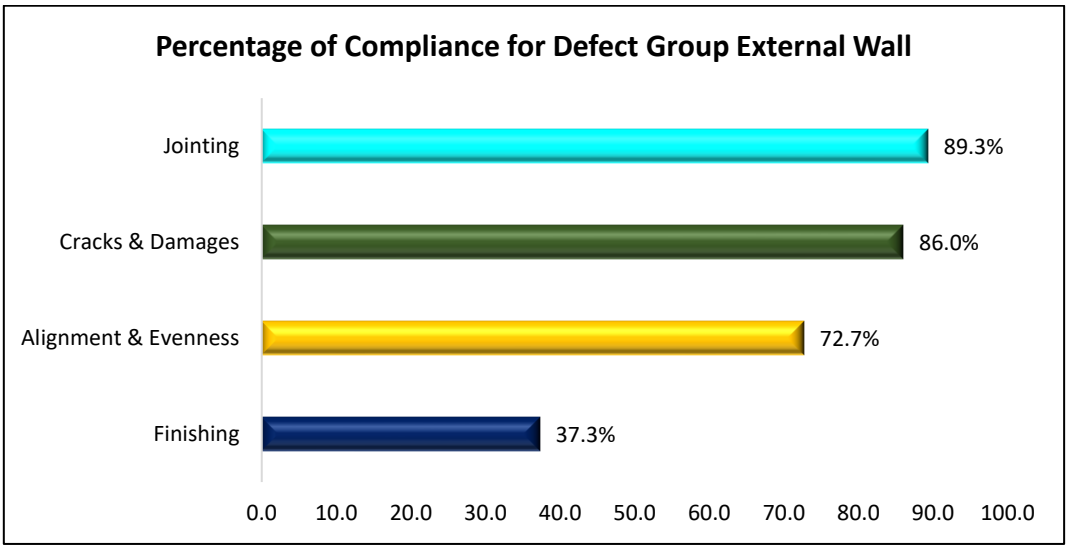


Figure 4.9: Percentage of Compliance for Defect Group External Wall (2015).

Figure 4.10 shows the percentage of compliance for defect group, Apron & Perimeter. The highest percentage of compliance is 99.4% for Apron 1 & Apron 2 followed by Inspection Chamber (87.0%). The lowest percentage of compliance is for Drain with 45.1%.

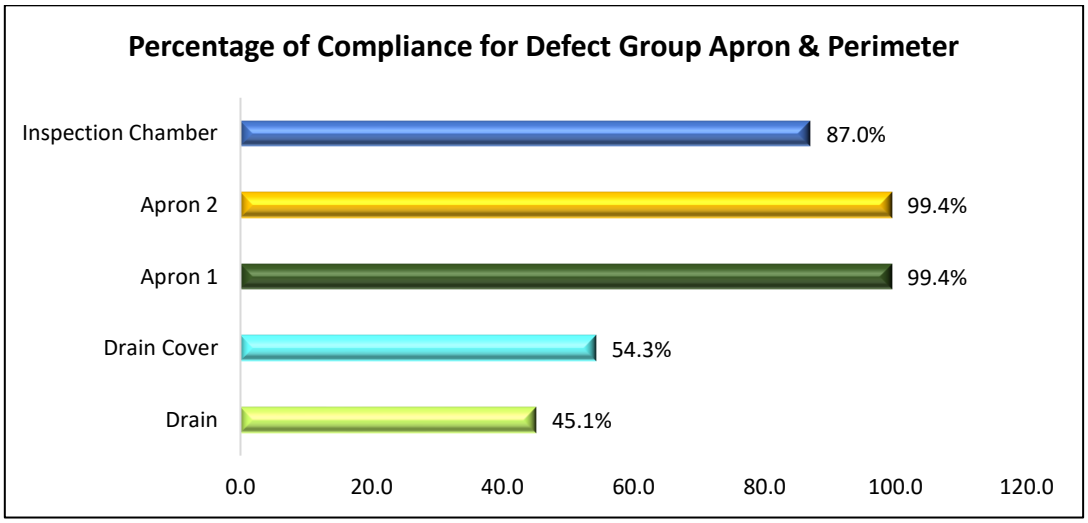


Figure 4.10: Percentage of Compliance for Defect Group Apron & Perimeter (2015).

Figure 4.11 shows the percentage of compliance for defect group, Car Park. The highest percentage of compliance is 100.0% for Fixtures, Ceiling & Floor. The lowest percentage of compliance is for Basic M&E Fittings with 99.0%.

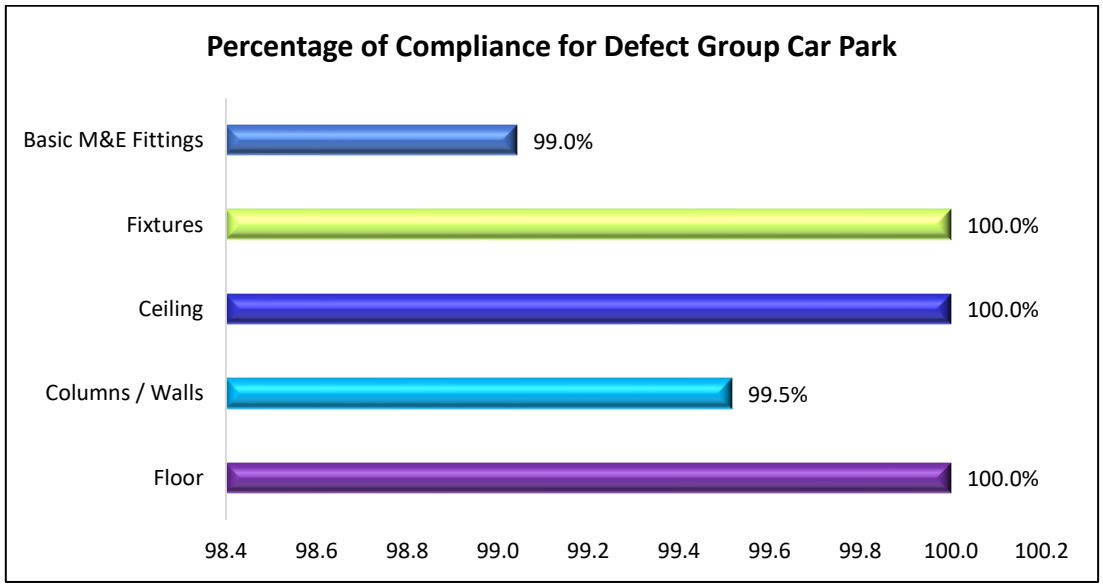


Figure 4.11: Percentage of Compliance for Defect Group Car Park (2015).

Figure 4.12 shows the percentage of compliance for defect group, Link-way/Shelter. The highest percentage of compliance is 99.2% for Columns, followed by Basic M&E Fittings (97.8%). The lowest percentage of compliance is for Floor with 14.9%.

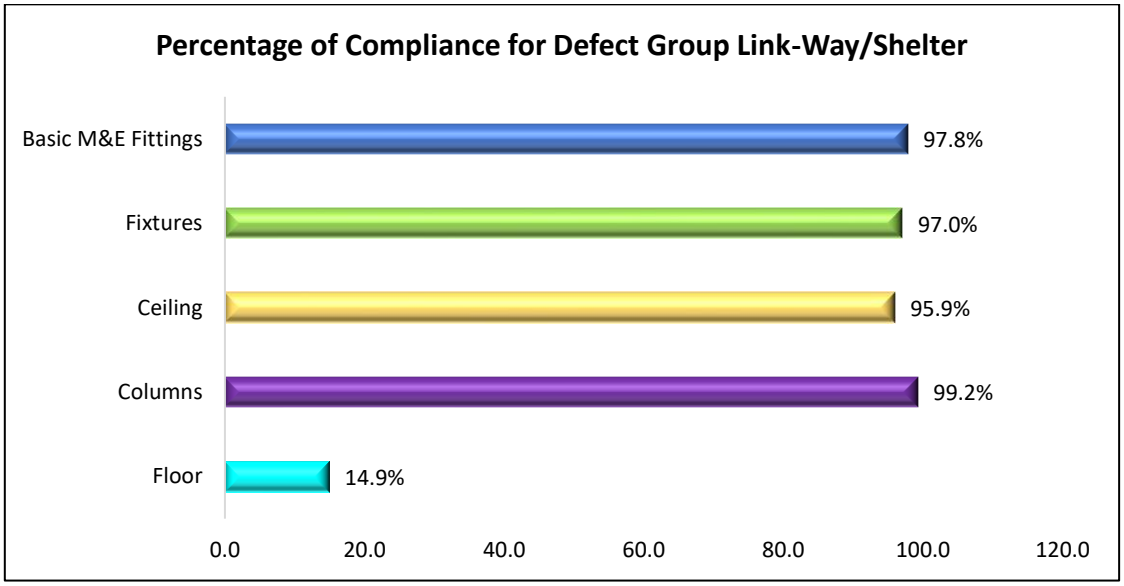


Figure 4.12: Percentage of Compliance for Defect Group Link-way/Shelter (2015).

Figure 4.13 shows the percentage of compliance for defect group, External Drain. The highest percentage of compliance is 92.5% for Drain Cover followed by Drain 2 (90.3%). The lowest percentage of compliance is for Drain 1 with 76.0%.

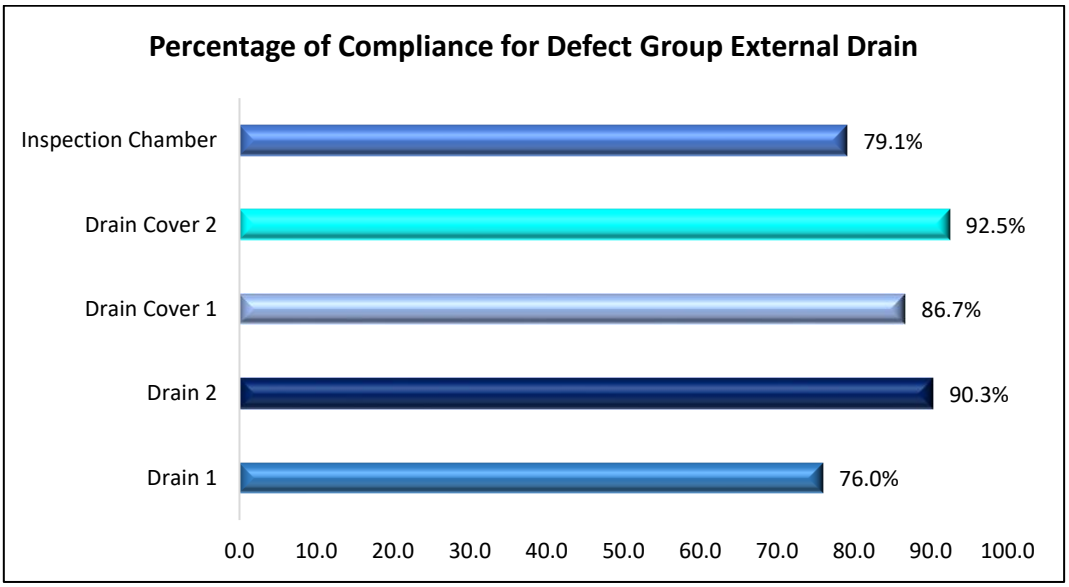


Figure 4.13: Percentage of Compliance for Defect Group External Drain (2015).

Figure 4.14 shows the percentage of compliance for defect group, Roadwork & Car Park on the Ground. The highest percentage of compliance is 99.3% for Road Signs, followed by Kerbs (95.6%). The lowest percentage of compliance is for Road Markings, with 58.9%.

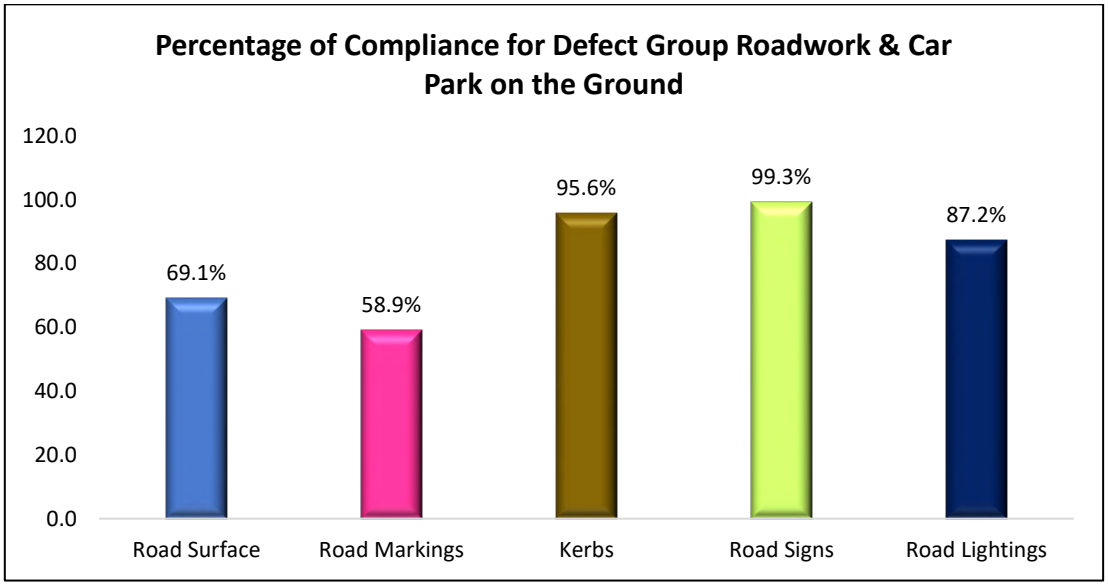


Figure 4.14: Percentage of Compliance for Defect Group Roadwork & Car Park (2015).

Figure 4.15 shows the percentage of compliance for defect group, Footpath & Turfing. The highest percentage of compliance is 99.6% for Turfing, followed by Fixtures (93.4%). The lowest percentage of compliance is for Footpath 1, with 81.5%.

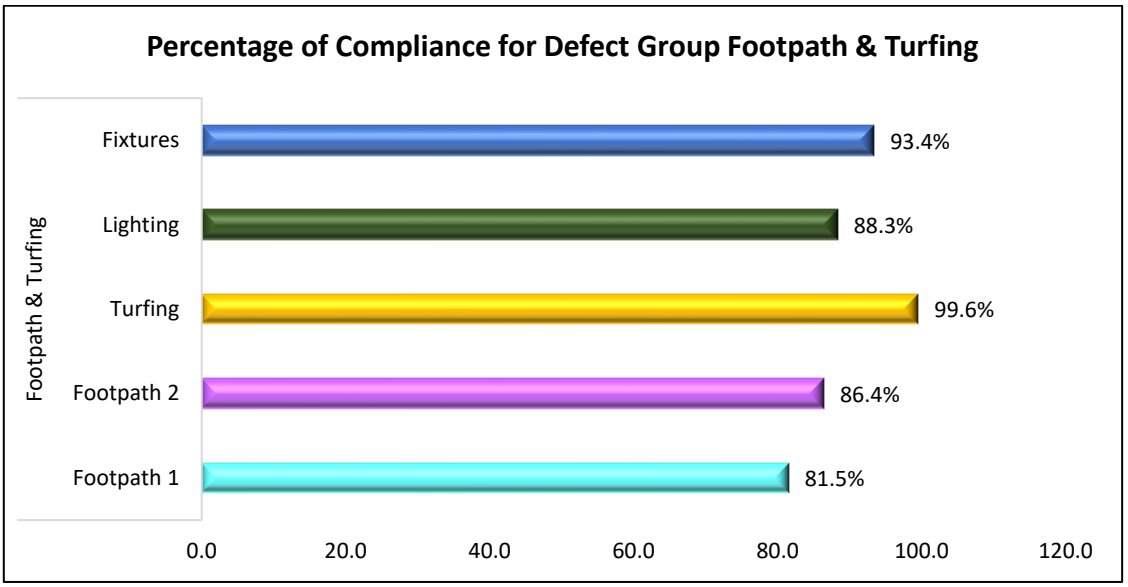


Figure 4.15: Percentage of Compliance for Defect Group Footpath & Turfing (2015).

Figure 4.16 shows the percentage of compliance for defect group, Playground. The highest percentage of compliance is 94.7% for Side Drain, followed by Playground Equipment (93.2%). The lowest percentage of compliance is for Floor, with 69.8%.

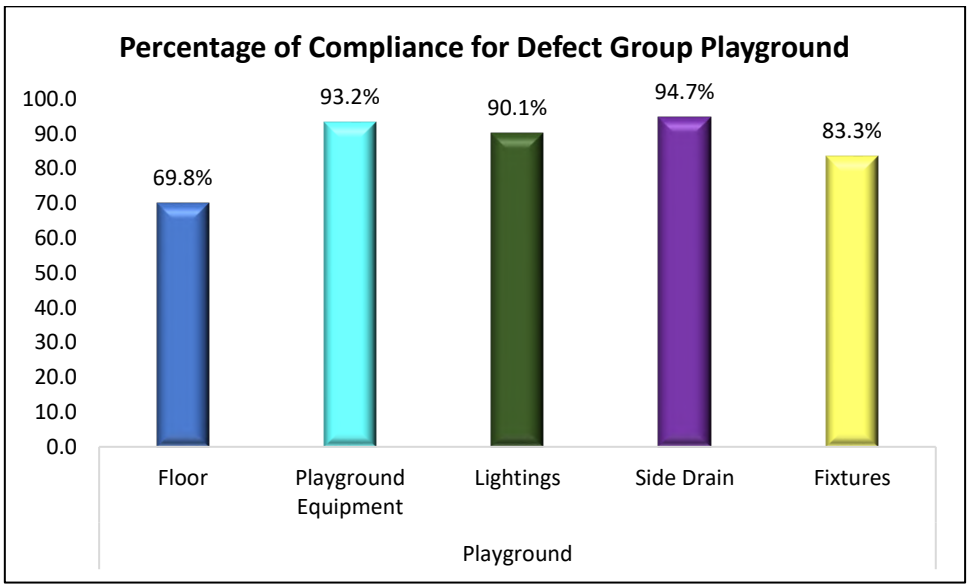


Figure 4.16: Percentage of Compliance for Defect Group Playground (2015).

Figure 4.17 shows the percentage of compliance for defect group, Court. The highest percentage of compliance is 95.0% for Fixtures, followed by Floor 1 (80.5%). The lowest percentage of compliance is for Signages, with 68.0%.

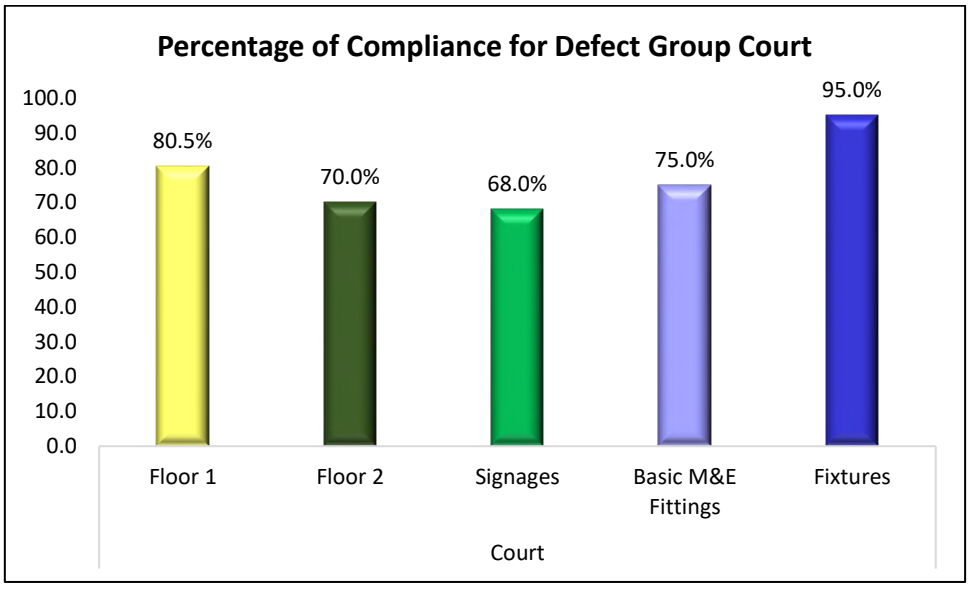


Figure 4.17: Percentage of Compliance for Defect Group Court (2015).

Figure 4.18 shows the percentage of compliance for defect group, Fencing & Gate. The highest percentage of compliance is 99.3% for Basic M&E Fittings, followed by Gate (97.5%). The lowest percentage of compliance is for Fence 1 with 43.2%.

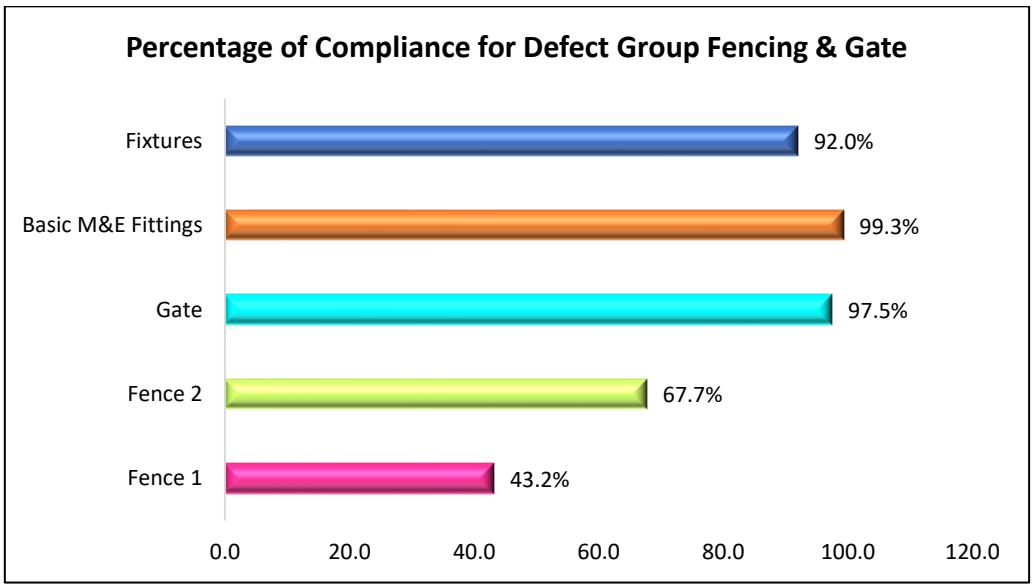


Figure 4.18: Percentage of Compliance for Defect Group Fencing & Gate (2015).

Figure 4.19 shows the percentage of compliance for defect group, Swimming Pool. The highest percentage of compliance is 100.0% for Ladder & Railing, followed by Basic M&E Fittings (91.9%). The lowest percentage of compliance is for Overflow Drain with 62.9%.

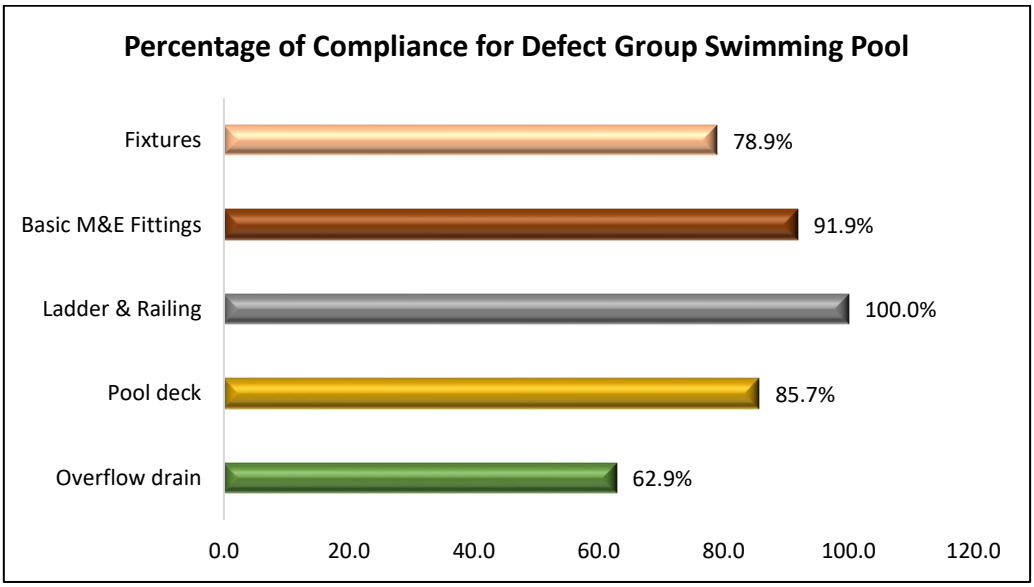


Figure 4.19: Percentage of Compliance for Defect Group Swimming Pool (2015).

Figure 4.20 shows the percentage of compliance for defect group, Electrical Substation. The highest percentage of compliance is 98.1% for Apron & Drain Cover, followed by Window (97.0%). The lowest percentage of compliance is for External Wall with 34.5%.

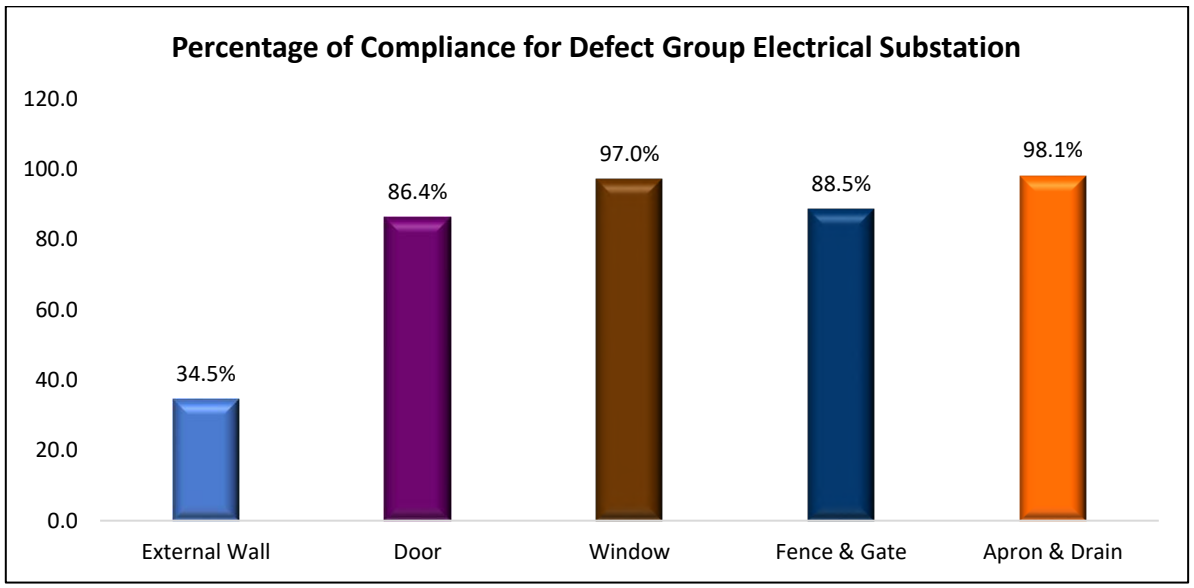


Figure 4.20: Percentage of Compliance for Defect Group Electrical Substation (2015).

Figure 4.21 shows the percentage of compliance for defect group, Guard House. The highest percentage of compliance is 100.0% for Apron & Drain, and Door & Window followed by Barrier (81.3%). The lowest percentage of compliance is for Roof with 15.4%.

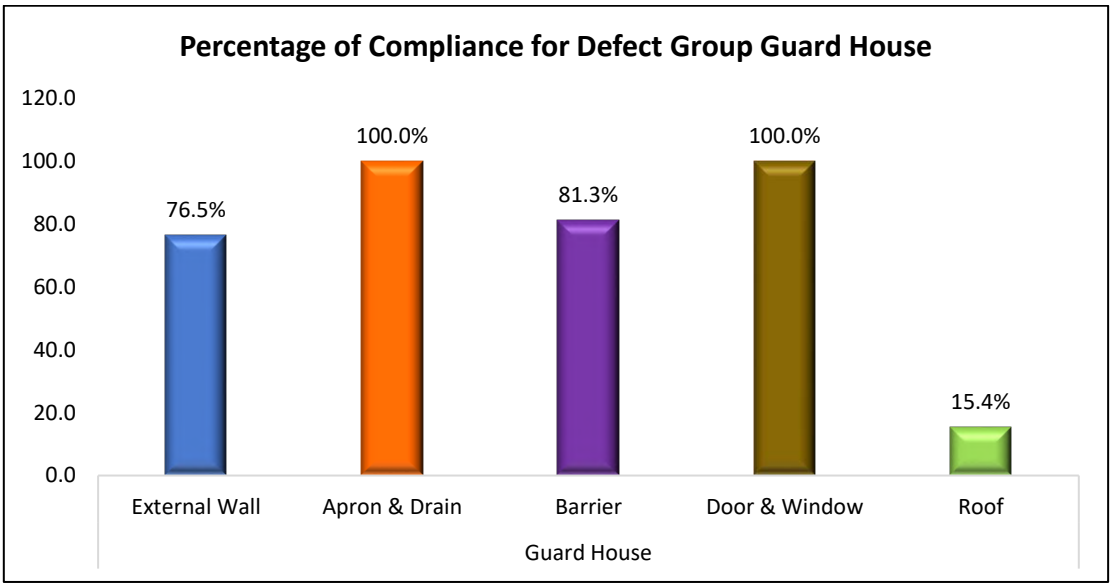


Figure 4.21: Percentage of Compliance for Defect Group Guard House (2015).

Figure 4.22 shows the percentage of compliance for defect group, Bin Centre. The highest percentage of compliance is 92.3% for Apron & Drain, followed by Roof (91.7%). The lowest percentage of compliance is for External Wall with 38.5%.

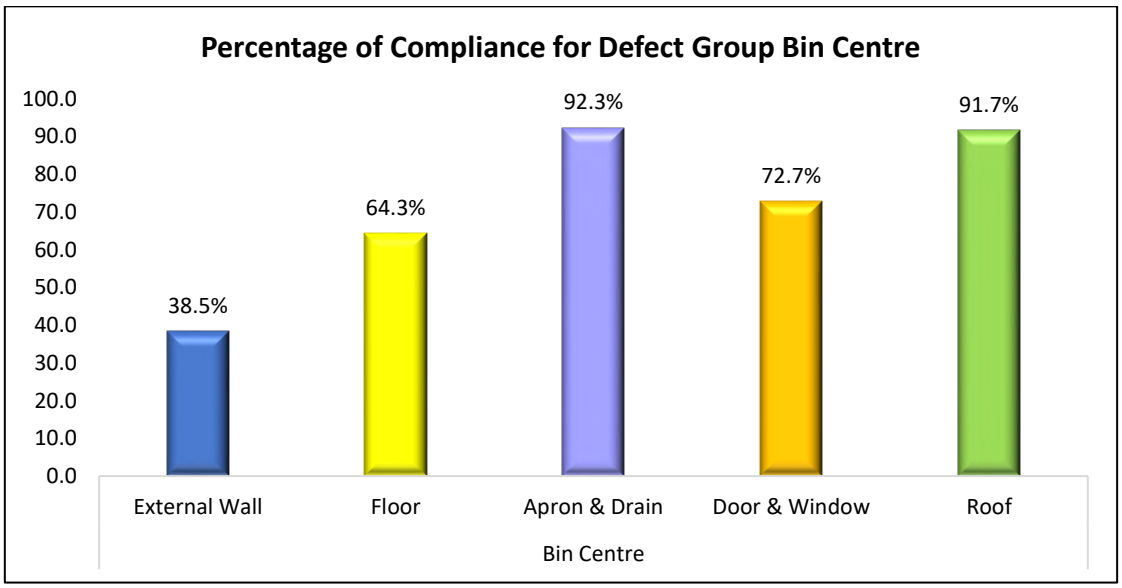


Figure 4.22: Percentage of Compliance for Defect Group Bin Centre (2015).

Figure 4.23 shows the percentage of compliance for defect group, Basic M&E Fittings. The highest percentage of compliance is 97.7% for Alignment & Evenness, followed by Functionality (97.4%). The lowest percentage of compliance is for Joints & Gaps, with 59.8%.

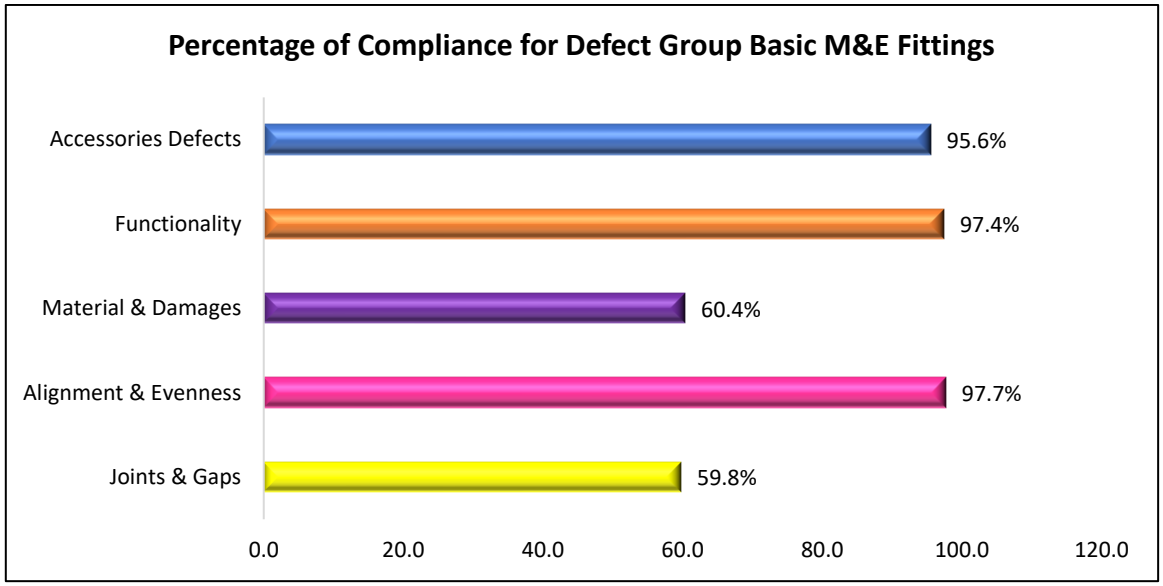


Figure 4.23: Percentage of Compliance for Defect Group Basic M&E Fittings (2015).

B. 2016

Figure 4.24 shows the total number of assessed locations for 2016. The majority of assessed locations is represented by Principal, followed by Service and Circulation.

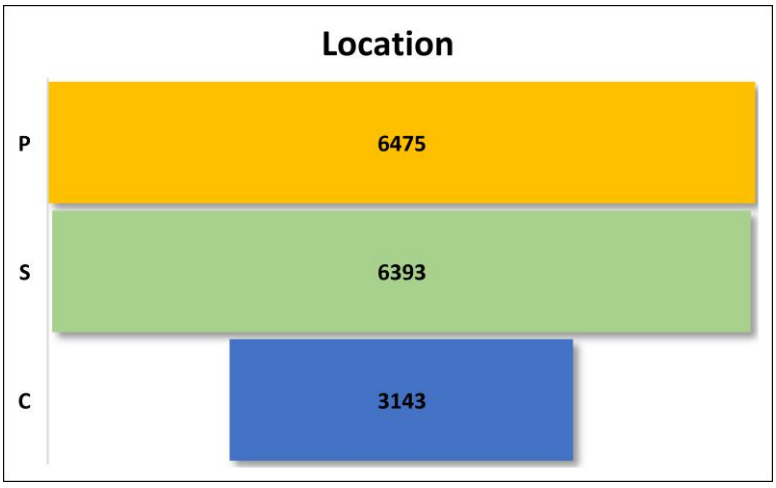


Figure 4.24: Total Number of Assessed Locations (2016).

Figure 4.25 shows the percentage of compliance the defect group, Floor. The highest percentage of compliance is 99.0% for Alignment & Evenness, followed by Crack & Damages (92.5%). The lowest percentage of compliance is for Finishing at 21.7%.

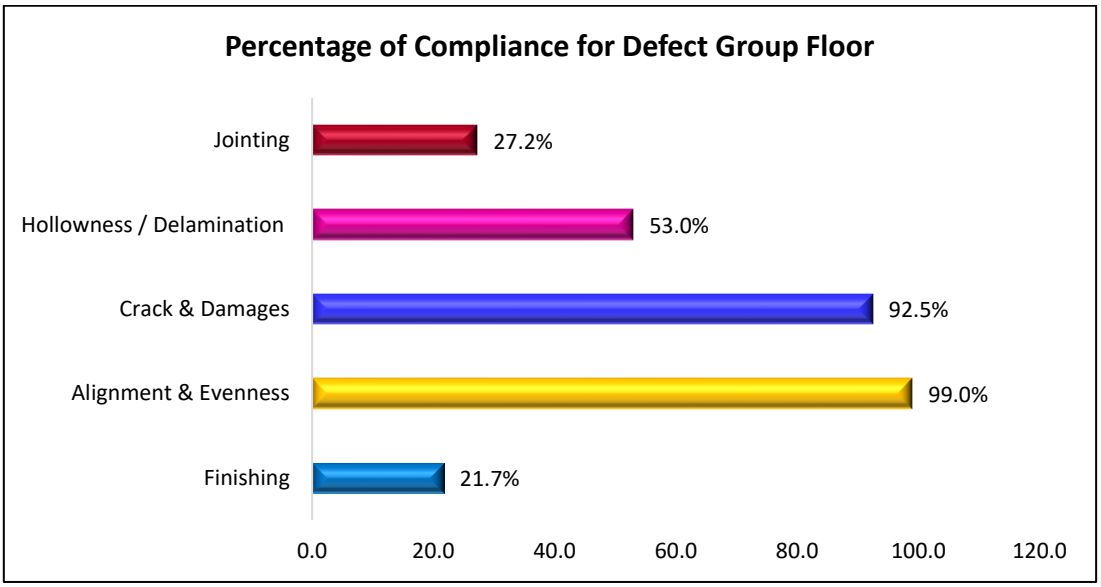


Figure 4.25: Percentage of Compliance for Defect Group Floor (2016).

Figure 4.26 shows the percentage of compliance for defect group, Wall. The highest percentage of compliance is 91.6% for Alignment & Evenness, followed by Crack & Damages (87.1%). The lowest percentage of compliance is for Finishing at 17.3%.

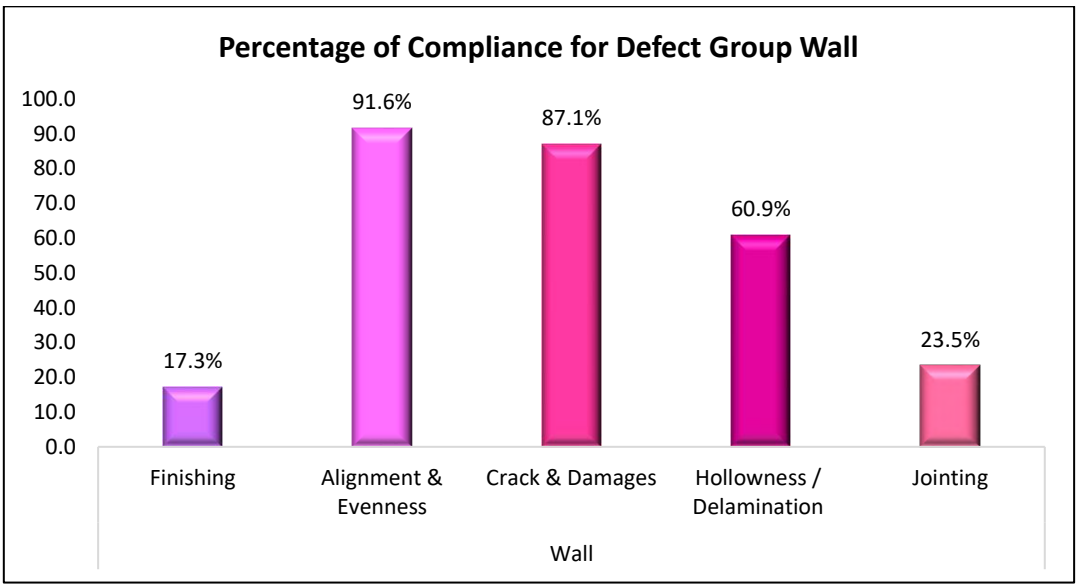


Figure 4.26: Percentage of Compliance for Defect Group Wall (2016).

Figure 4.27 shows the percentage of compliance for defect group, Ceiling. The highest percentage of compliance is 97.7% for Alignment & Evenness, followed by Roughness/Patchiness (95.9%). The lowest percentage of compliance is for Finishing at 16.6%.

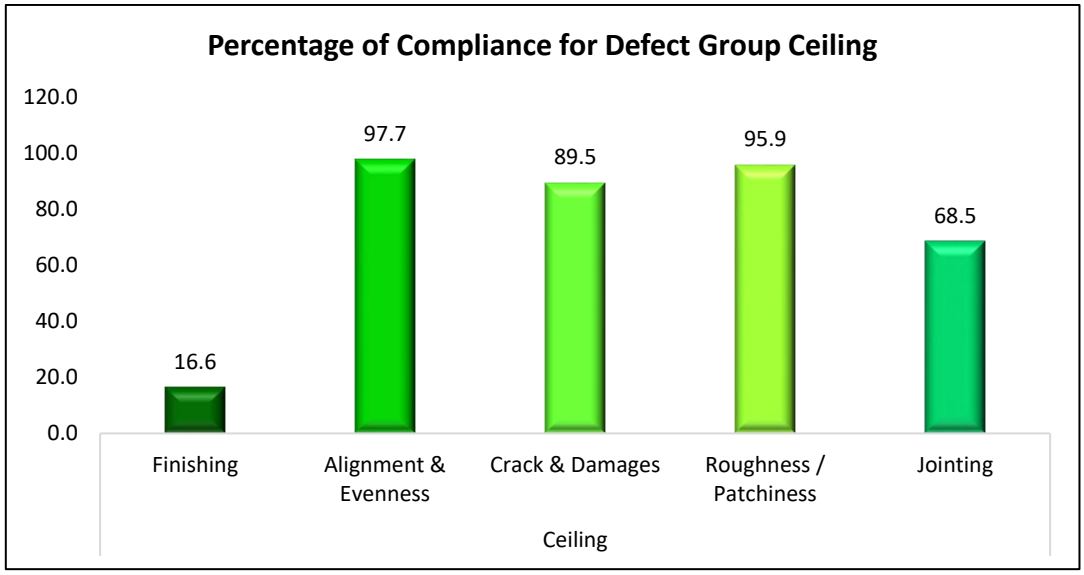


Figure 4.27: Percentage of Compliance for Defect Group Ceiling (2016).

Figure 4.28 shows the percentage of compliance for defect group, Door. The highest percentage of compliance is 98.3% for Functionality, followed by Alignment & Evenness (92.8%). The lowest percentage of compliance is for Material & Damages with 25.9%.

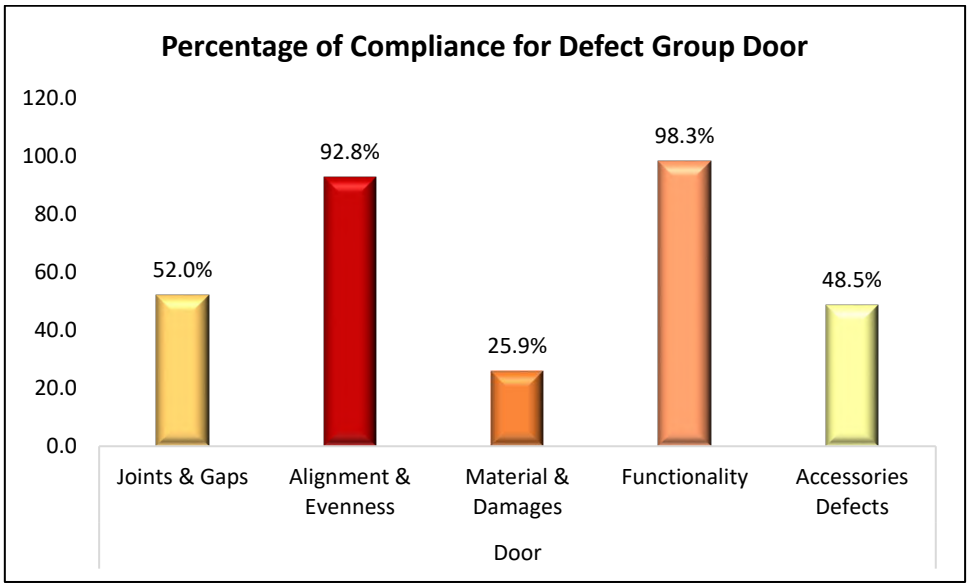


Figure 4.28: Percentage of Compliance for Defect Group Door (2016).

Figure 4.29 shows the percentage of compliance for defect group, Window. The highest percentage of compliance is 97.9% for Functionality, followed by Alignment & Evenness (97.5%). The lowest percentage of compliance is for Material & Damages with 23.9%.

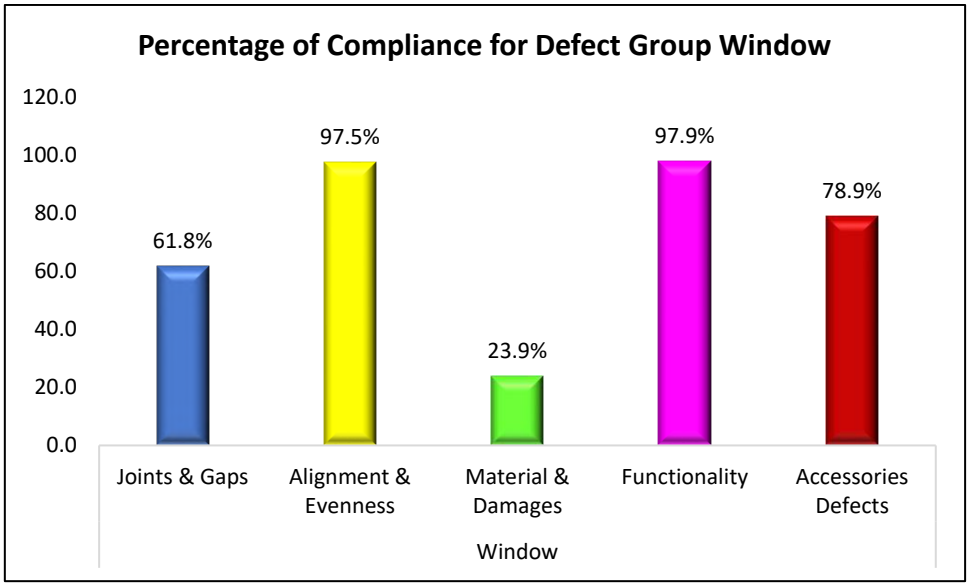


Figure 4.29: Percentage of Compliance for Defect Group Window (2016).

Figure 4.30 shows the percentage of compliance for defect group, Internal Finishing. The highest percentage of compliance is 99.0% for Alignment & Evenness, followed by Functionality (98.7%). The lowest percentage of compliance is for Material & Damages with 64.0%.

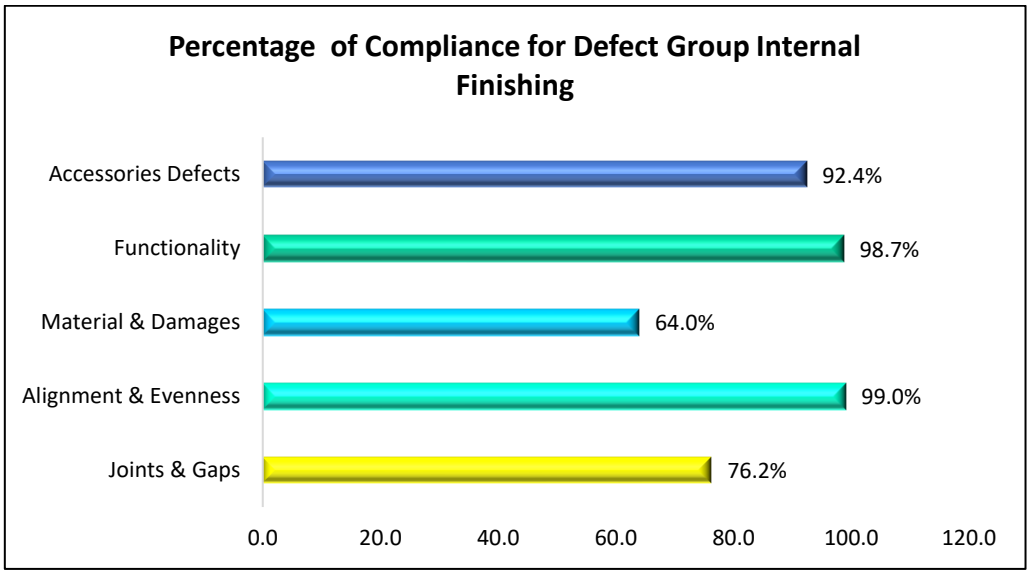


Figure 4.30: Percentage of Compliance for Defect Group Internal Finishing (2016).

Figure 4.31 shows the percentage of compliance for defect group, Roof. The highest percentage of compliance is 97.6% for Chokage & Ponding, followed by Rough/Uneven/Falls (95.2%). The lowest percentage of compliance is for Finishing at 37.1%.

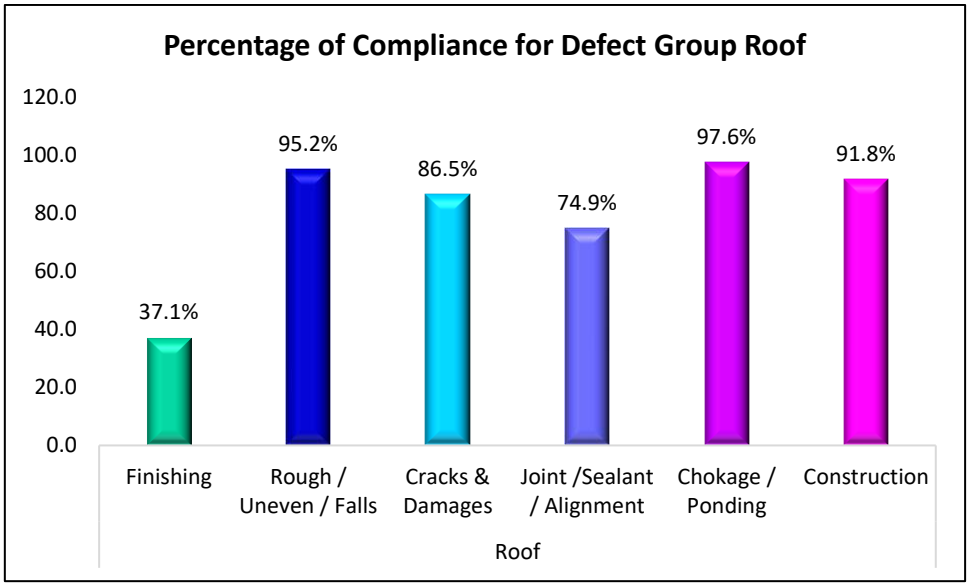


Figure 4.31: Percentage of Compliance for Defect Group Roof (2016)

Figure 4.32 shows the percentage of compliance for defect group, External Finishing. The highest percentage of compliance is 94.9% for Jointing, followed by Crack & Damages (90.4%). The lowest percentage of compliance is for Finishing at 16.7%.

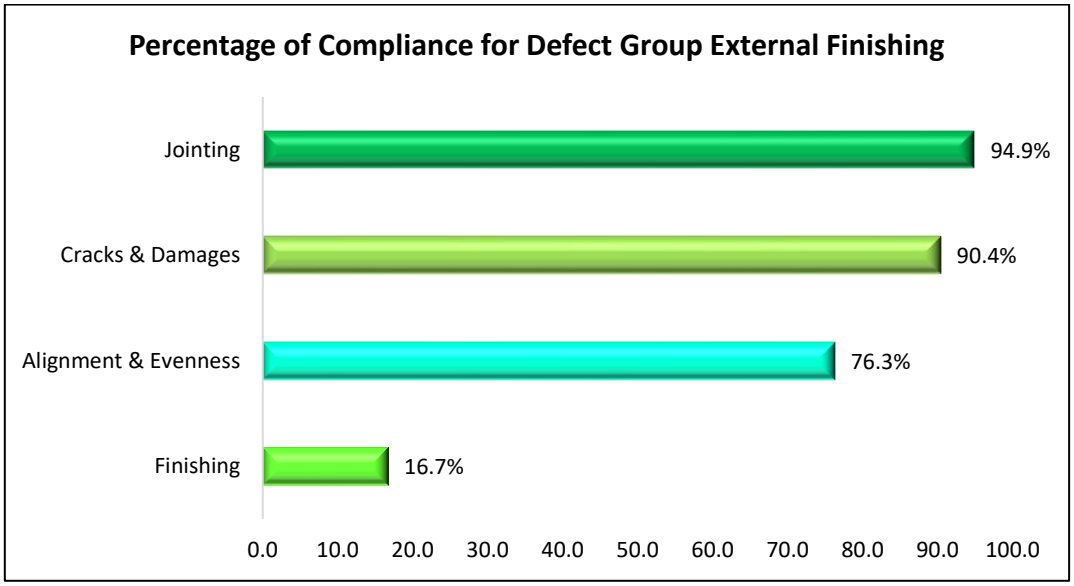


Figure 4.32: Percentage of Compliance for Defect Group External Finishing (2016).

Figure 4.33 shows the percentage of compliance for defect group, Apron & Perimeter Drain. The highest percentage of compliance is 98.0% for Apron 1, followed by Apron 2 (97.6%). The lowest percentage of compliance is for Drain with 25.1%.

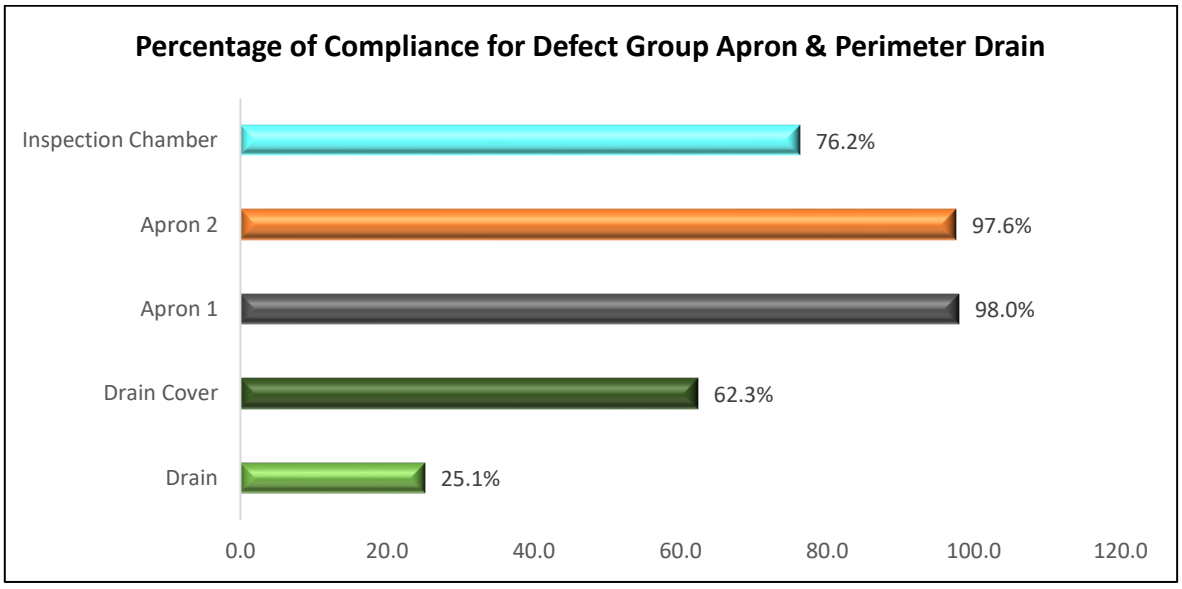


Figure 4.33: Percentage of Compliance for Defect Group Apron & Perimeter Drain (2016).

Figure 4.34 shows the percentage of compliance for defect group, Car Park/Car Porch. All defect groups achieved 100.0% compliance.

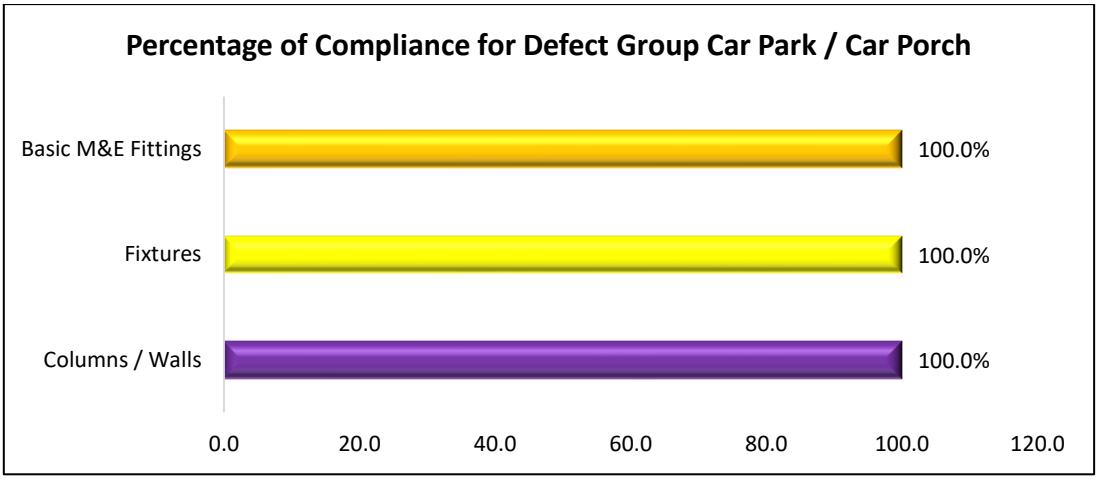


Figure 4.34: Percentage of Compliance for Defect Group Car Park/Car Porch (2016).

Figure 4.35 shows the percentage of compliance for defect group, Link-way/Shelter. The highest percentage of compliance is 100.0% for Basic M&E Fittings, followed by Fixtures (95.0%). The lowest percentage of compliance is for Floor with 41.7%.

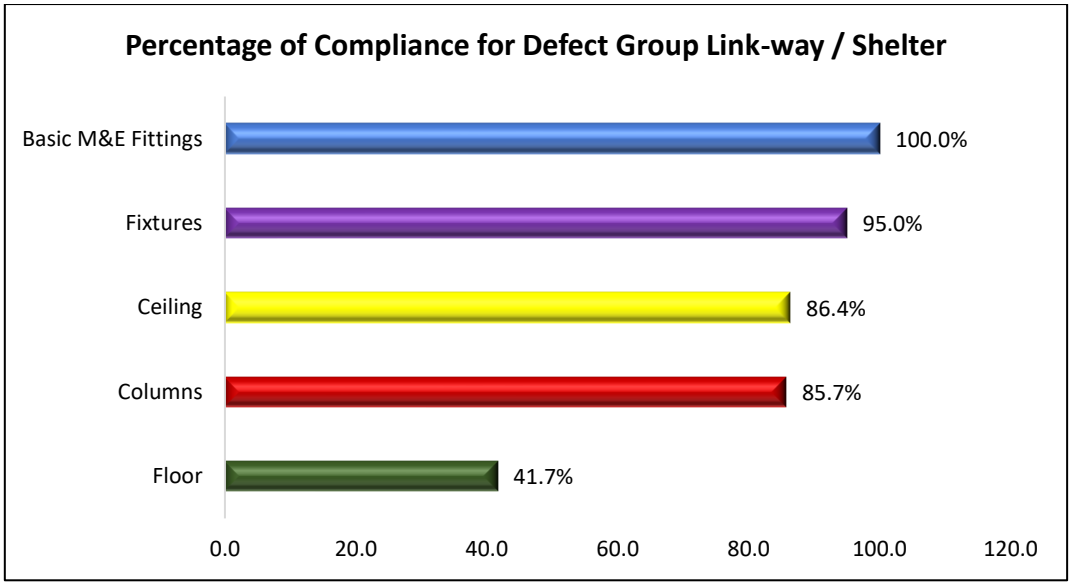


Figure 4.35: Percentage of Compliance for Defect Group Link-way/Shelter (2016).

Figure 4.36 shows the percentage of compliance for defect group, External Drain. The highest percentage of compliance is 89.7% for Inspection Chamber followed by Drain 2 (87.7%). The lowest percentage of compliance is for Drain 1 with 50.4%.

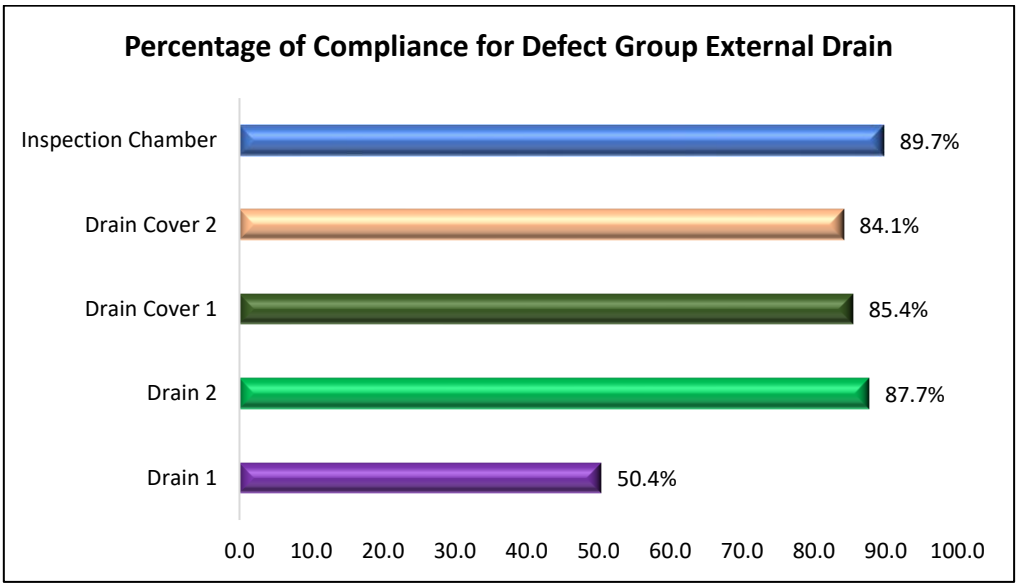


Figure 4.36: Percentage of Compliance for Defect Group External Drain (2016).

Figure 4.37 shows the percentage of compliance for defect group, Roadwork & Car Park. The highest percentage of compliance is 98.5% for Kerbs, followed by Road Signs (95.6%). The lowest percentage of compliance is for Road Surface, with 34.6%.

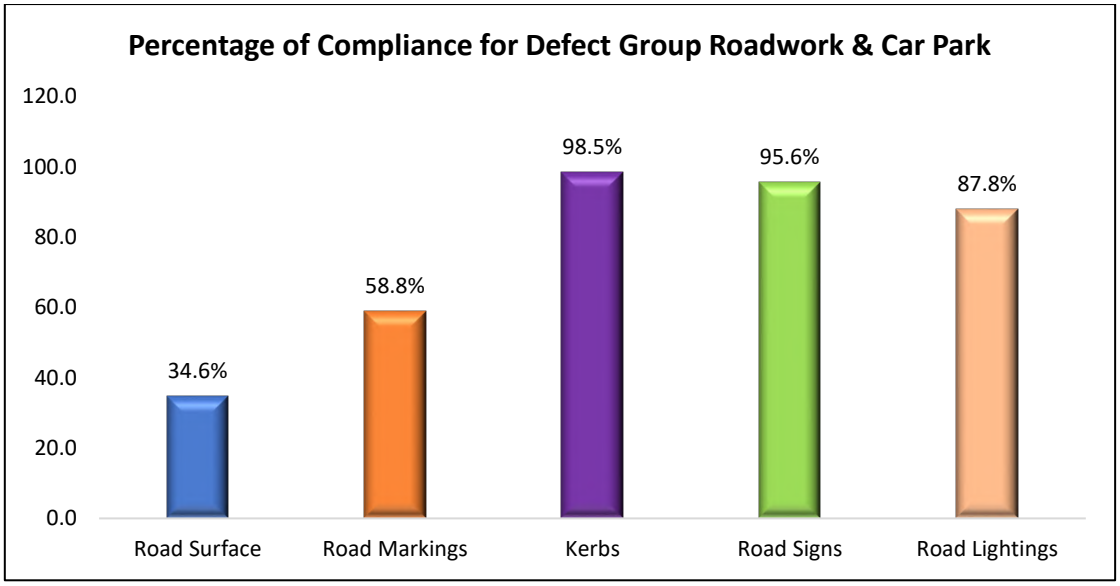


Figure 4.37: Percentage of Compliance for Defect Group Roadwork & Car Park (2016).

Figure 4.38 shows the percentage of compliance for defect group, Footpath & Turfing. The highest percentage of compliance is 100.0% for Fixtures and Lighting, followed by Turfing (99.1%). The lowest percentage of compliance is for Footpath, with 76.7%.

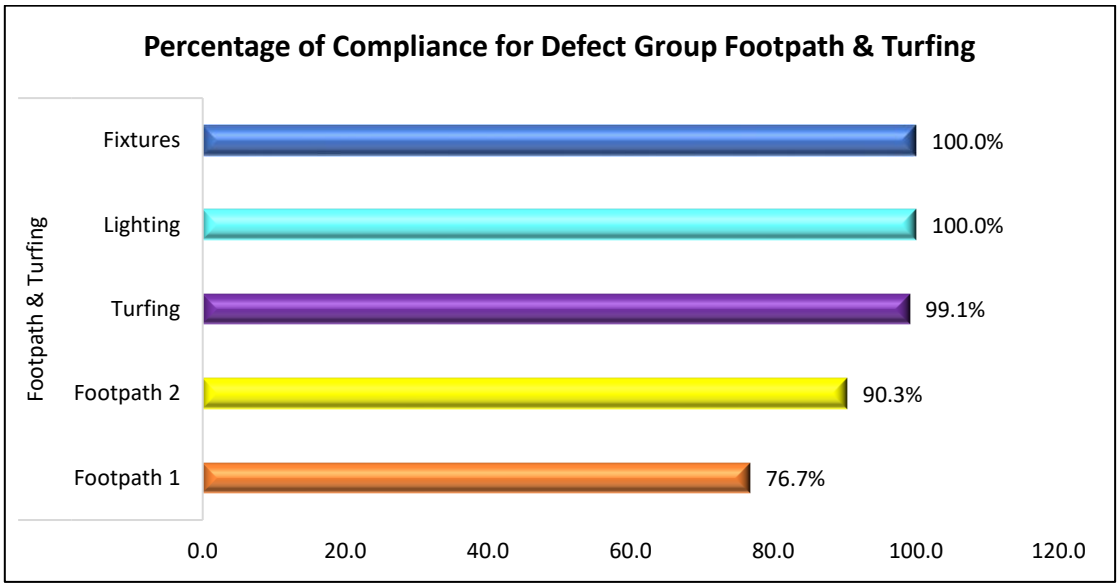


Figure 4.38: Percentage of Compliance for Defect Group Footpath & Turfing (2016).

Figure 4.39 shows the percentage of compliance for defect group, Playground. The highest percentage of compliance is 100.0% for Playground Equipment and Lightings, followed by Side Drain (95.7%). The lowest percentage of compliance is for Floor with 73.1%.

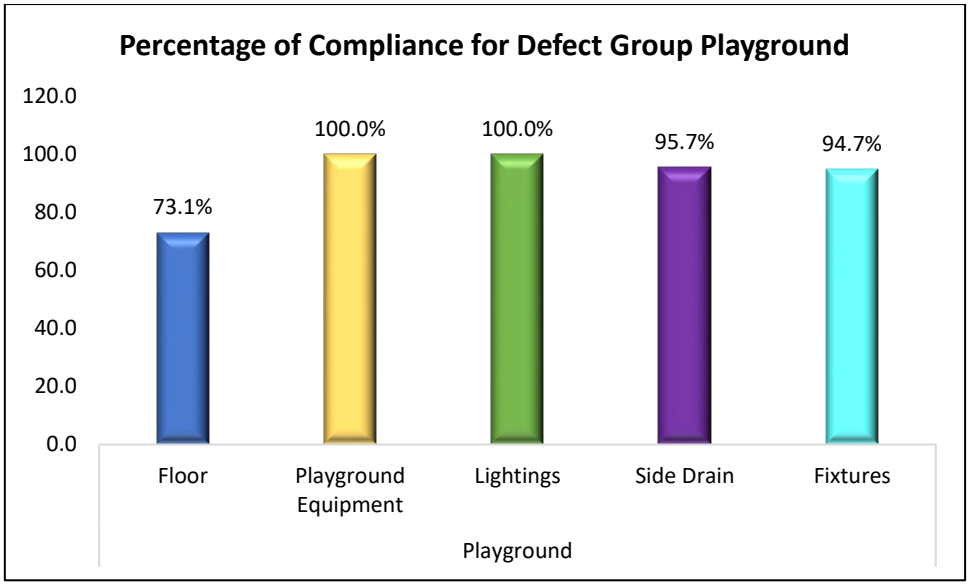


Figure 4.39: Percentage of Compliance for Defect Group Playground (2016).

Figure 4.40 shows the percentage of compliance for defect group, Court. The highest percentage of compliance is 100.0% for Basic M&E Fittings, followed by Floor 2 and Signages (85.7%). The lowest percentage of compliance is for Floor 1, with 71.4%.

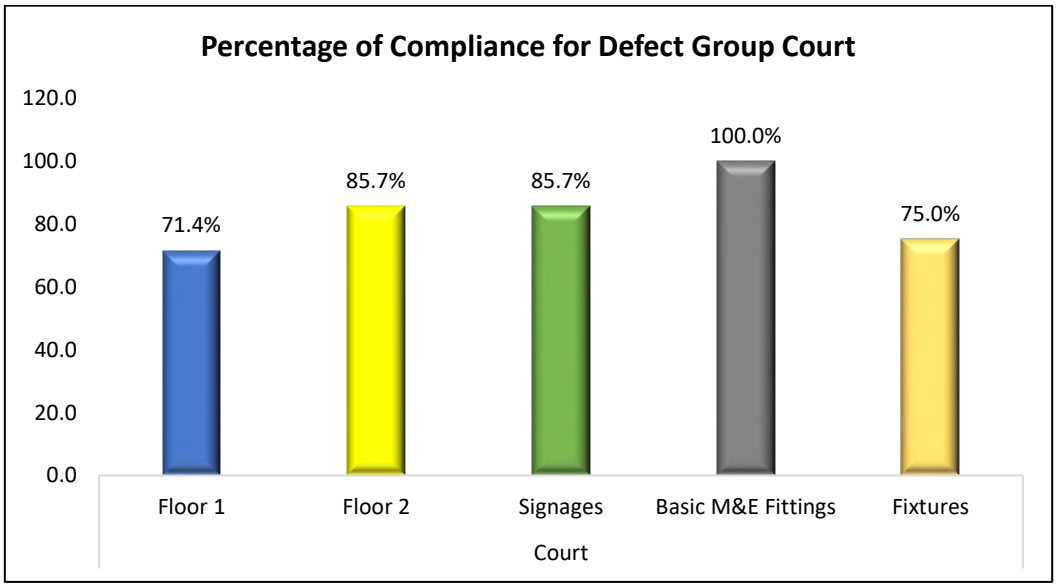


Figure 4.40: Percentage of Compliance for Defect Group Court (2016).

Figure 4.41 shows the percentage of compliance for defect group, Fencing & Gate. The highest percentage of compliance is 97.4% for Fixtures, followed by Basic M&E Fittings (97.2%). The lowest percentage of compliance is for Fence 1 with 53.0%.

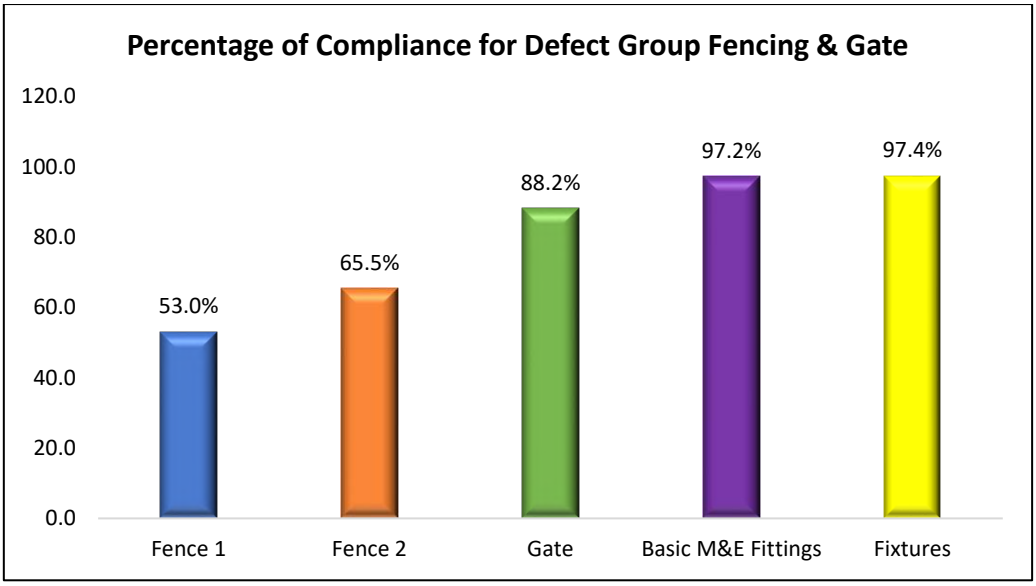


Figure 4.41: Percentage of Compliance for Defect Group Fencing & Gate (2016).

Figure 4.42 shows the percentage of compliance for defect group, Swimming Pool. The highest percentage of compliance is 100.0% for Ladder & Railing, followed by Fixtures (91.7%). The lowest percentage of compliance is for Pool deck and Overflow Drain with 78.6%.

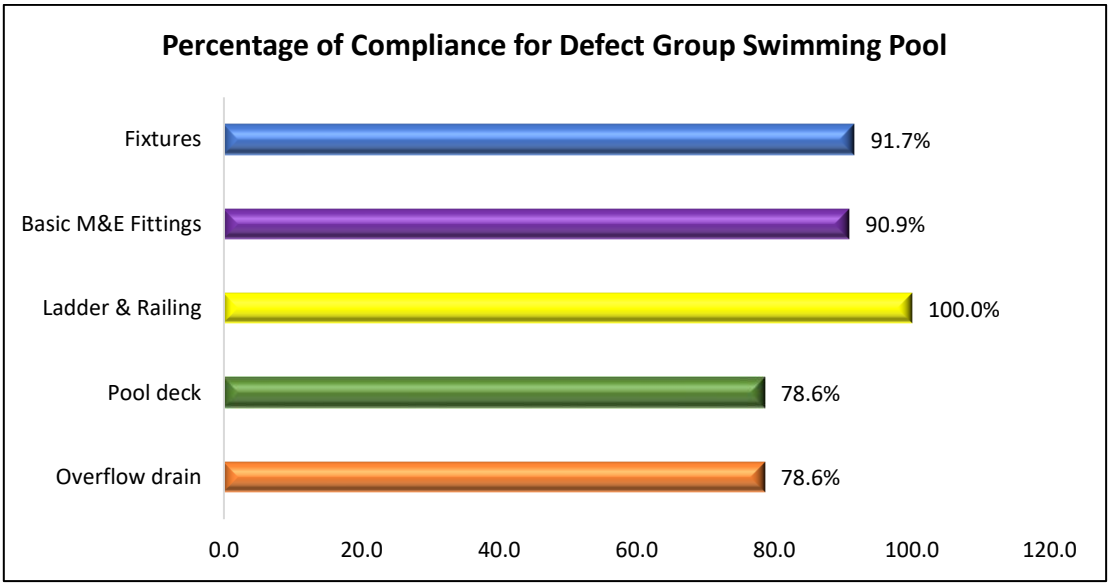


Figure 4.42: Percentage of Compliance for Defect Group Swimming Pool (2016).

Figure 4.43 shows the percentage of compliance for defect group, Electrical Substation. The highest percentage of compliance is 86.7% for Window, followed by Door (72.7%). The lowest percentage of compliance is for External Wall with 48.9%.

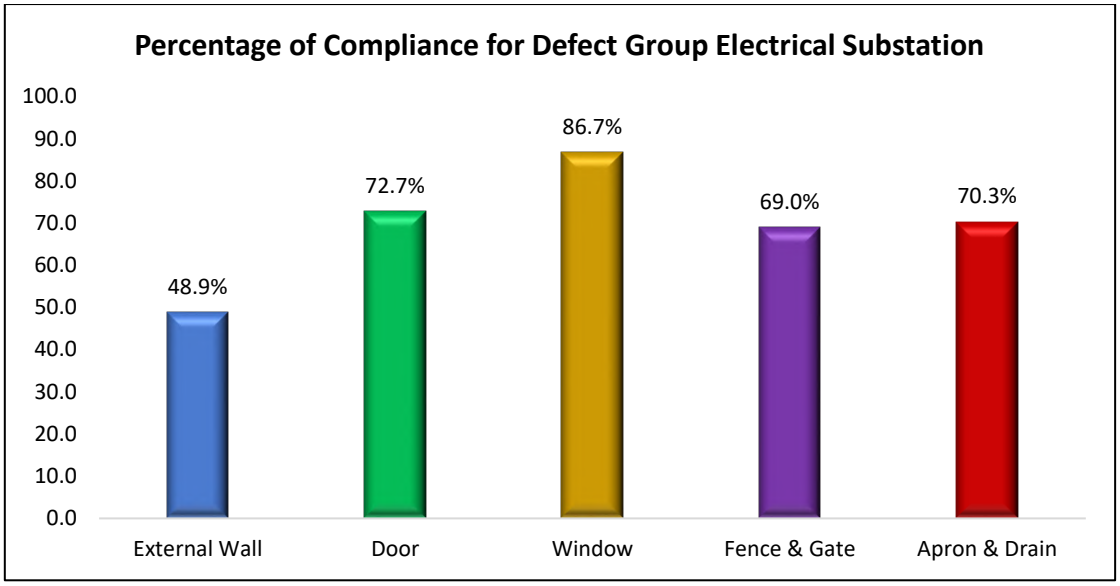


Figure 4.43: Percentage of Compliance for Defect Group Electrical Substation (2016).

Figure 4.44 shows the percentage of compliance for defect group, Basic M&E Fittings. The highest percentage of compliance is 96.8% for Alignment & Evenness, followed by Functionality & Safety (96.6%). The lowest percentage of compliance is for Joints & Gaps, with 55.1%.

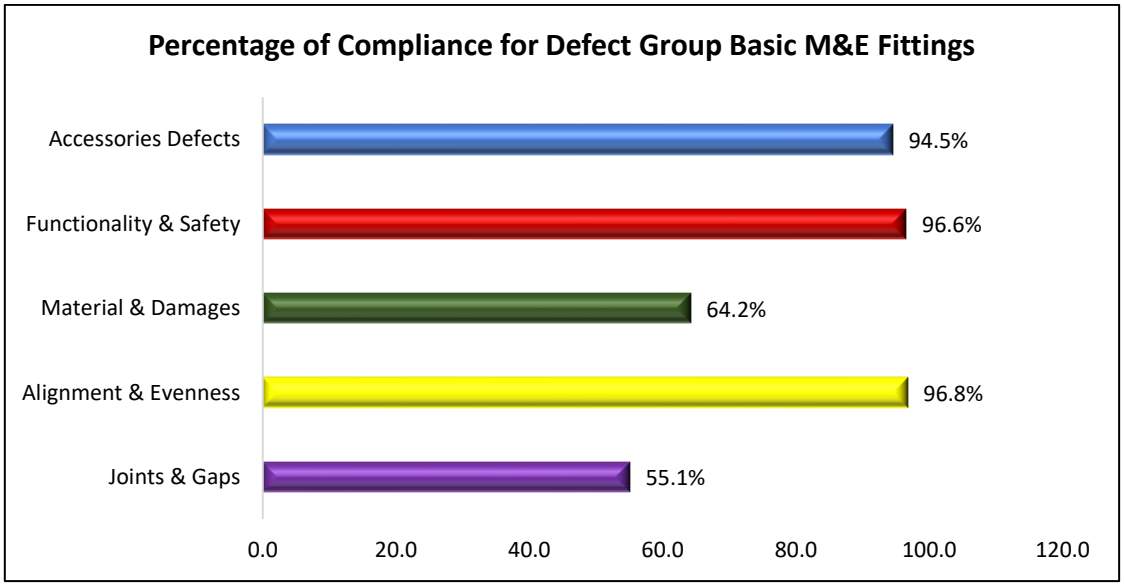


Figure 4.44: Percentage of Compliance for Defect Group Basic M&E Fittings (2016).

C. 2017

Figure 4.45 shows the total number of assessed locations for 2017. The majority of assessed locations is represented by Principal, followed by Service and Circulation.

Figure 4.45: Total Number of Assessed Location (2017).

Figure 4.46 shows the percentage of compliance for defect group, Floor. The highest percentage of compliance is 99.3% for Alignment & Evenness, followed by Crack & Damages (95.7%). The lowest percentage of compliance is for Finishing at 24.9%.

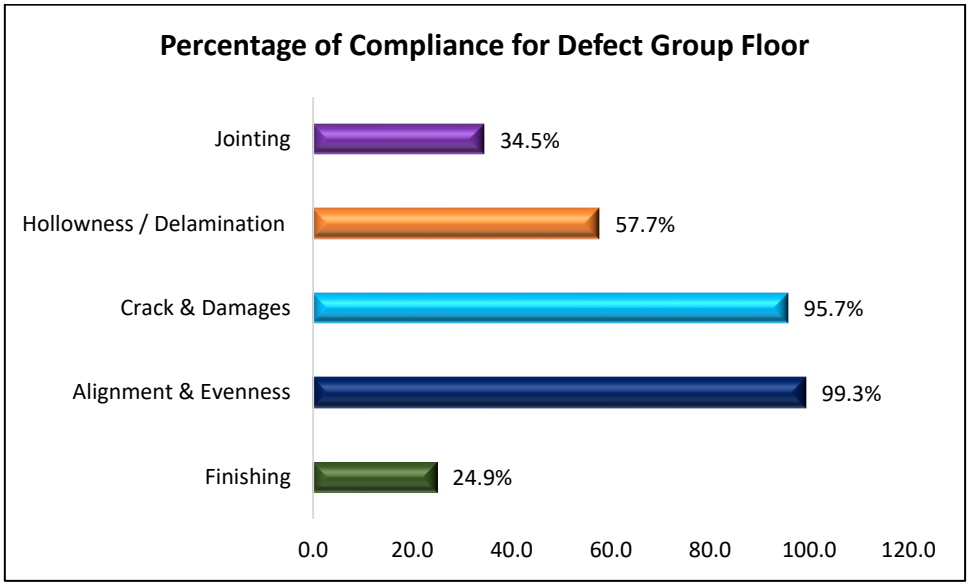


Figure 4.46: Percentage of Compliance for Defect Group Floor (2017).

Figure 4.47 shows the percentage of compliance for defect group, Wall. The highest percentage of compliance is 93.7% for Alignment & Evenness, followed by Crack & Damages (90.0%). The lowest percentage of compliance is for Finishing at 30.4%.

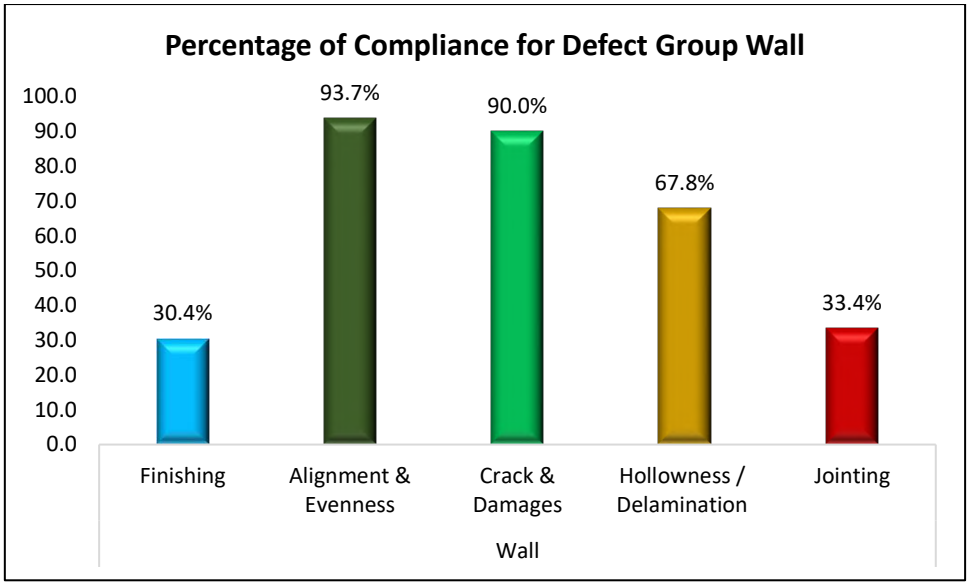


Figure 4.47: Percentage of Compliance for Defect Group Wall (2017).

Figure 4.48 shows the percentage of compliance for defect group, Ceiling. The highest percentage of compliance is 98.8% for Roughness/Patchiness, followed by Alignment & Evenness (98.1%). The lowest percentage of compliance is for Finishing at 33.9%.

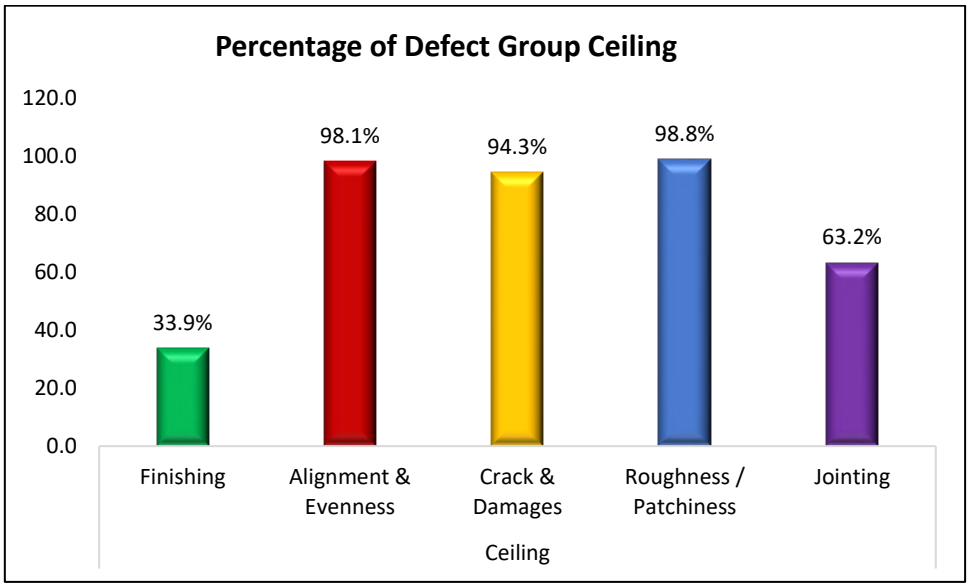


Figure 4.48: Percentage of Compliance for Defect Group Ceiling (2017).

Figure 4.49 shows the percentage of compliance for defect, Group Door. The highest percentage of compliance is 97.5% for Functionality, followed by Alignment & Evenness (92.2%). The lowest percentage of compliance is for Material & Damages with 36.3%.

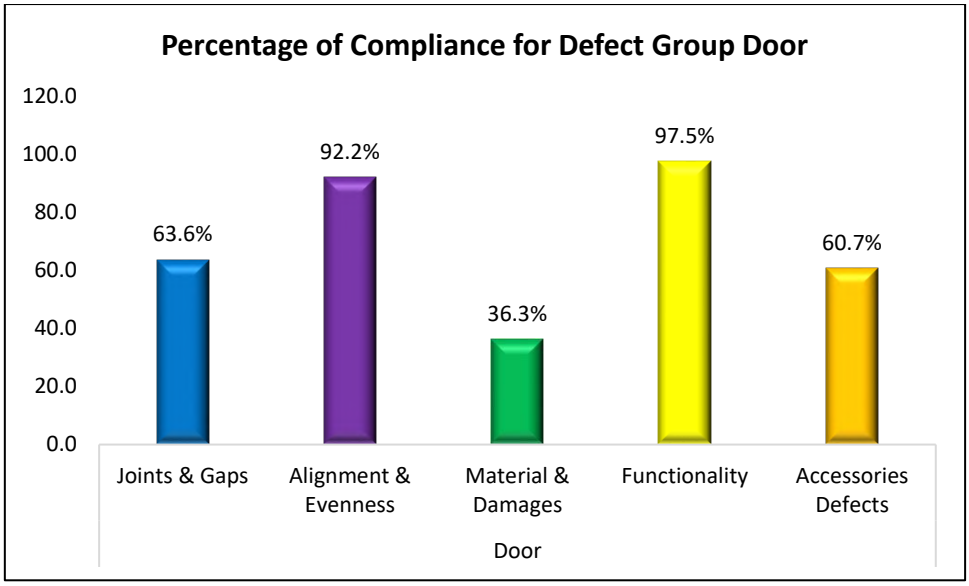


Figure 4.49: Percentage of Compliance for Defect Group Door (2017)

Figure 4.50 shows the percentage of compliance for defect group, Window. The highest percentage of compliance is 98.2% for Functionality, followed by Alignment & Evenness (94.0%). The lowest percentage of compliance is for Material & Damages with 32.0%.

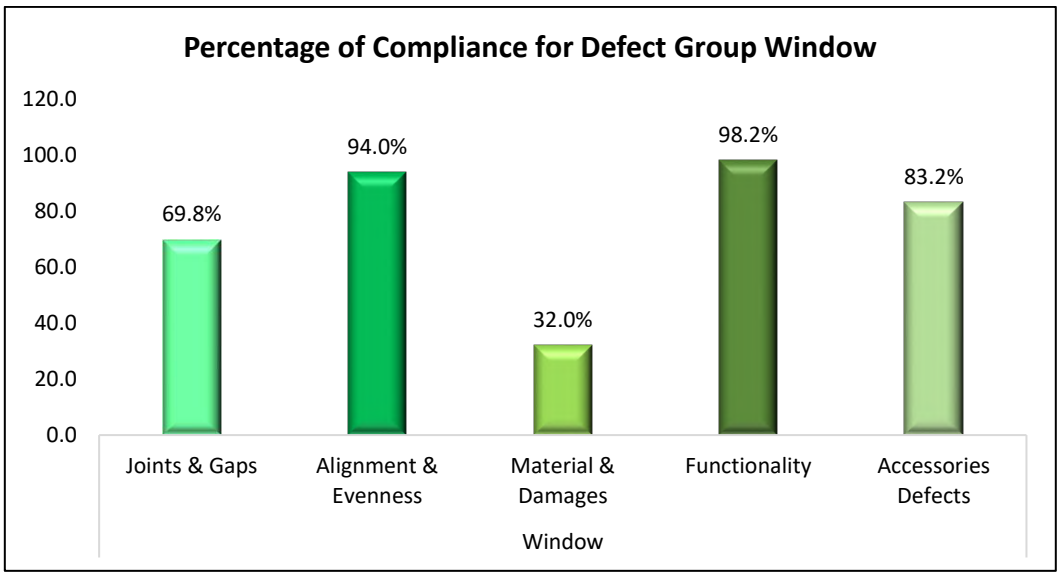


Figure 4.50: Percentage of Compliance for Defect Group Window (2017).

Figure 4.51 shows the percentage of compliance for defect group, Internal Fixtures. The highest percentage of compliance is 97.9% for Alignment & Evenness, followed by Accessories Defects (93.3%). The lowest percentage of compliance is for Functionality with 66.4%.

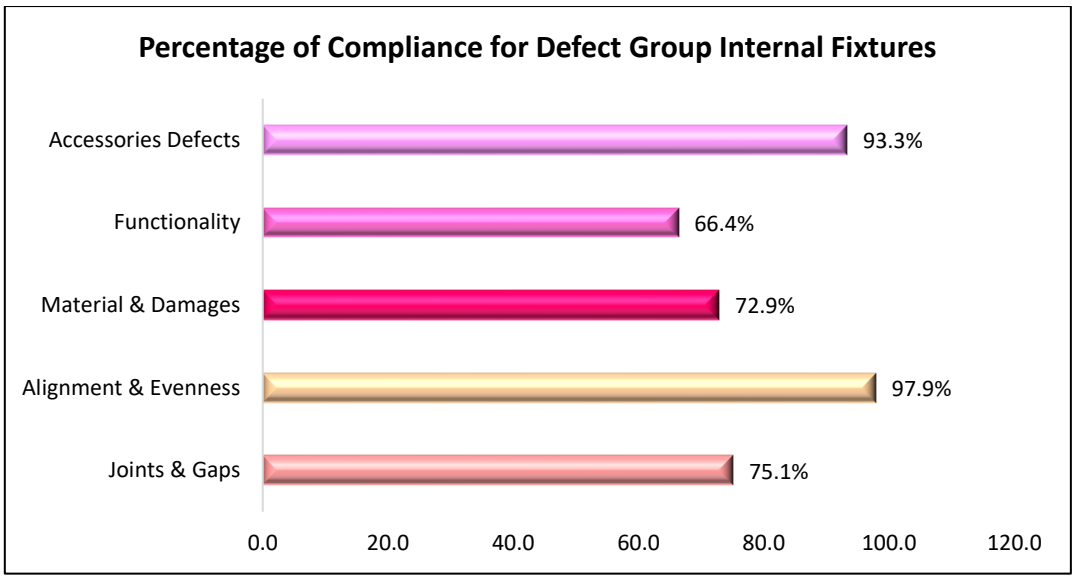


Figure 4.51: Percentage of Compliance for Defect Group Internal Fixtures (2017).

Figure 4.52 shows the percentage of compliance for defect group, Roof. The highest percentage of compliance is 99.9% for Chokage/Ponding, followed by Rough/Uneven/Falls (98.6%). The lowest percentage of compliance is for Finishing at 58.9%.

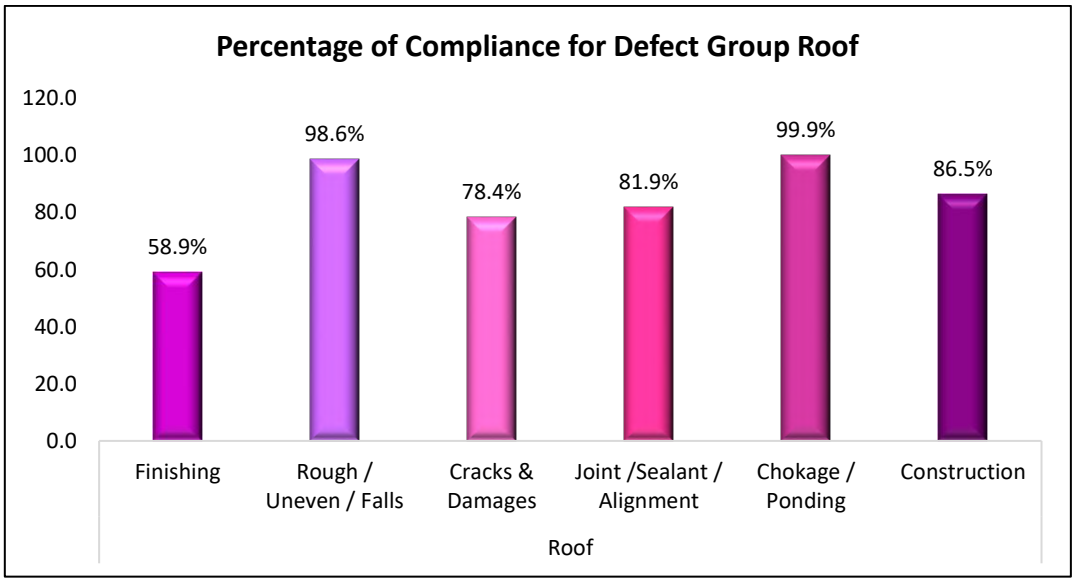


Figure 4.52: Percentage of Compliance for Defect Group Roof (2017).

Figure 4.53 shows the percentage of compliance for defect group, Floor. The highest percentage of compliance is 99.3% for Alignment & Evenness, followed by Crack & Damages (95.7%). The lowest percentage of compliance is for Finishing at 24.9%.

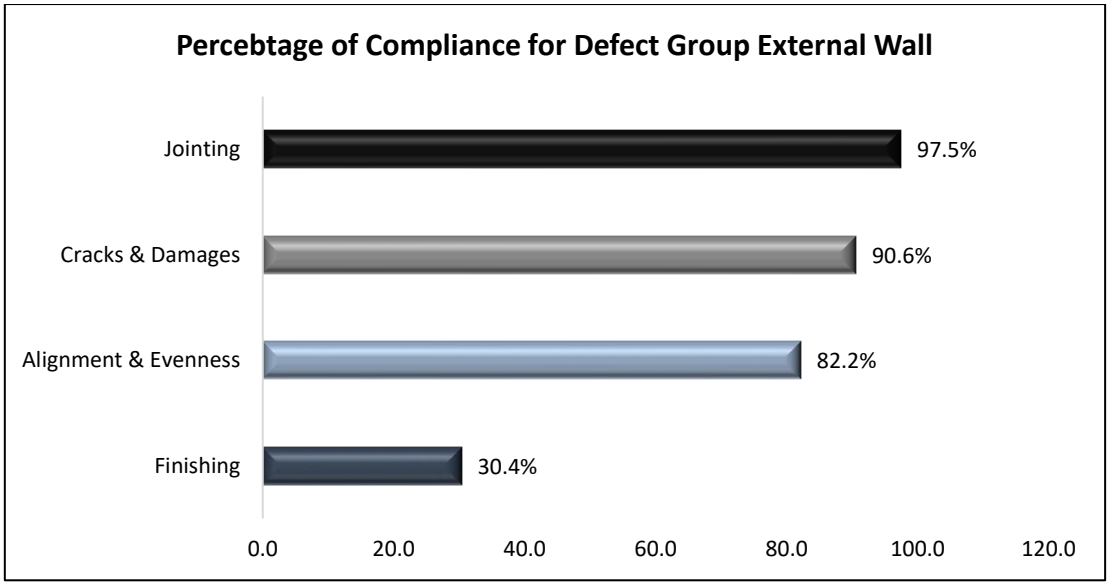


Figure 4.53: Percentage of Compliance for Defect Group External Wall (2017).

Figure 4.54 shows the percentage of compliance for defect group, Apron & Perimeter Drain. The highest percentage of compliance is 98.4% for Apron 2, followed by Apron 1 (98.1%). The lowest percentage of compliance is for Drain with 18.1%.

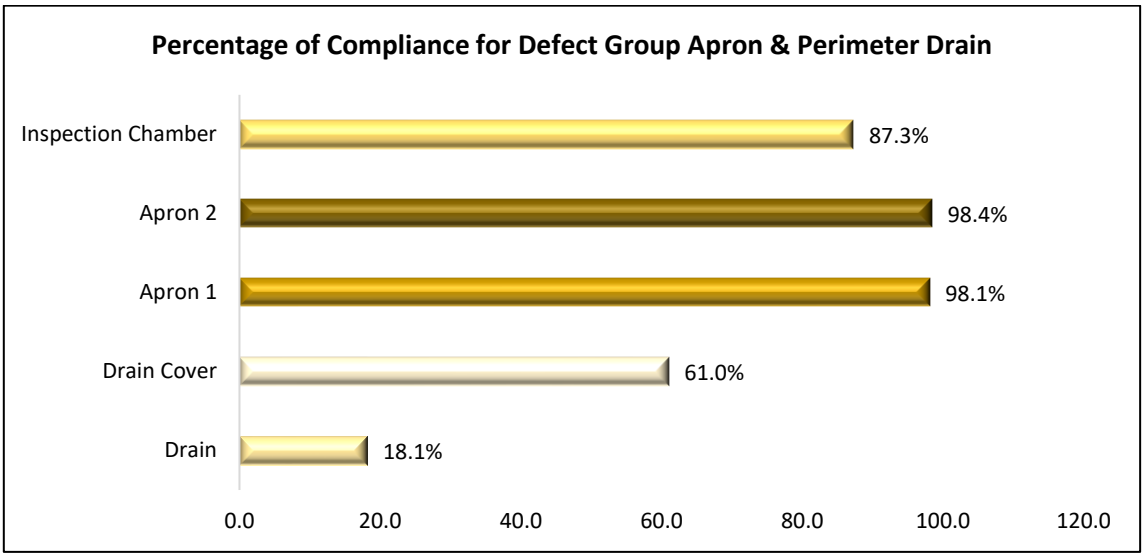


Figure 4.54: Percentage of Compliance for Defect Group Apron & Perimeter Drain (2017).

Figure 4.55 shows the percentage of compliance for defect group, Car Park/Car Porch. The highest percentage of compliance is 100.0% for Fixtures and Ceiling, followed by Basic M&E Fittings (95.7%). The lowest percentage of compliance is for Floor with 28.6%.

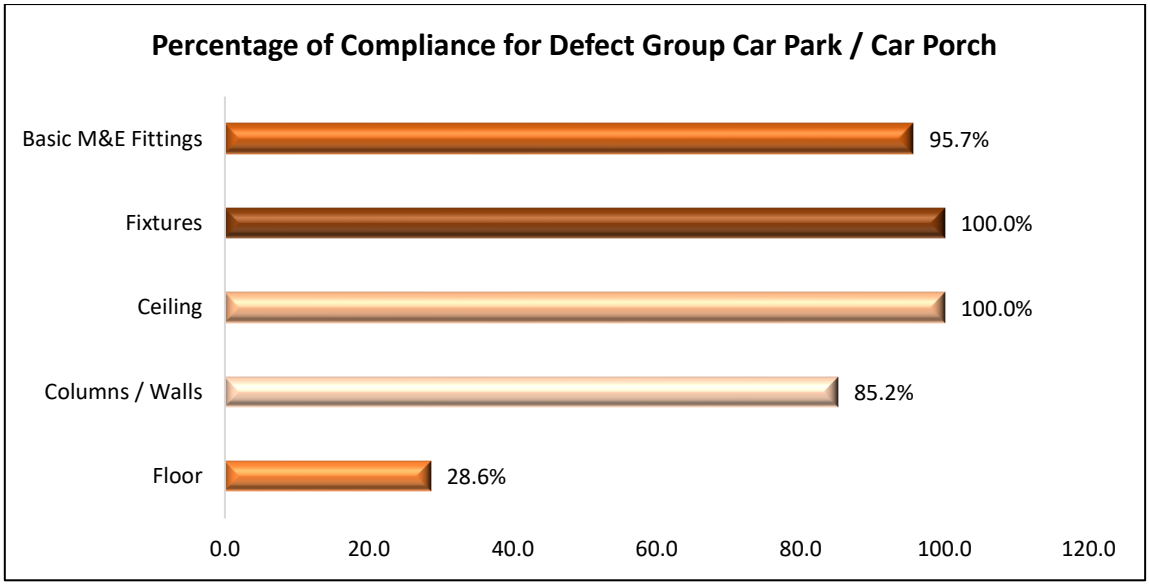


Figure 4.55: Percentage of Compliance for Defect Group Car Park/Car Porch (2017).

Figure 4.56 shows the percentage of compliance for defect group, Lin-Way/Shelter. The highest percentage of compliance is 100.0% for Fixtures, followed by Basic M&E Fittings (95.5%). The lowest percentage of compliance is for Floor with 62.5%.

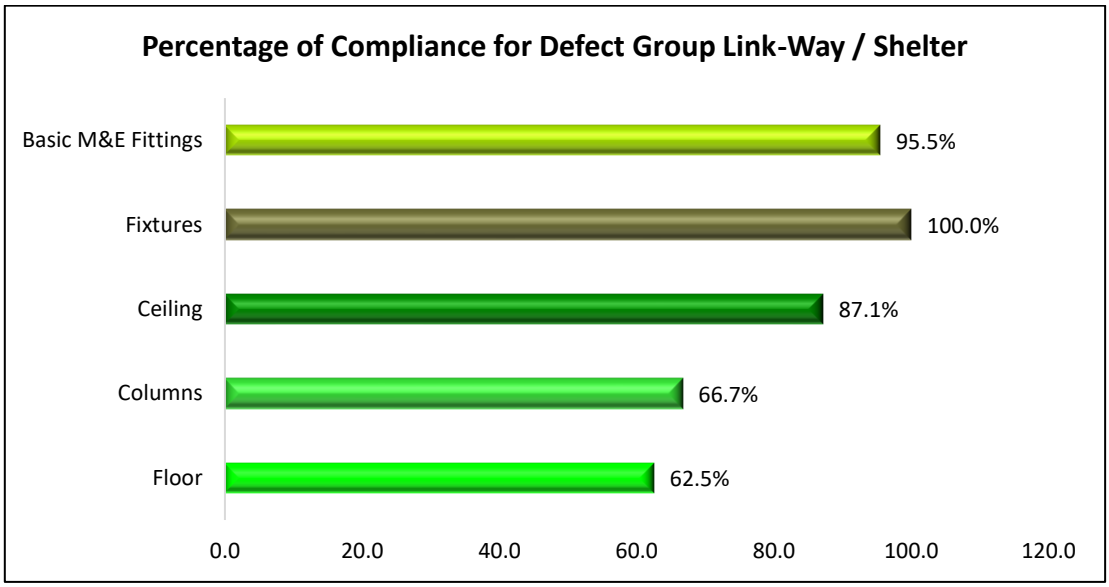


Figure 4.56: Percentage of Compliance for Defect Group Link-way/Shelter (2017).

Figure 4.57 shows the percentage of compliance for defect group, External Drain. The highest percentage of compliance is 94.8% for Inspection Chamber followed by Drain Cover 2 (87.2%). The lowest percentage of compliance is for Drain 1 with 59.9%.

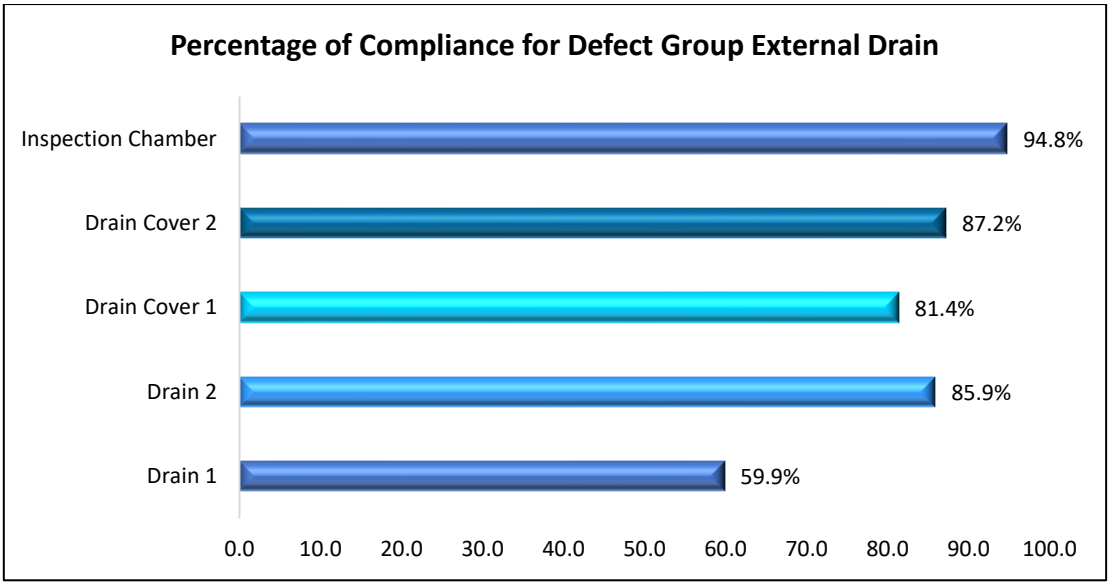


Figure 4.57: Percentage of Compliance for Defect Group External Drain (2017).

Figure 4.58 shows the percentage of compliance for defect group, Roadwork & Car Park on the Ground. The highest percentage of compliance is 98.3% for Road Signs, followed by Road Lightings (86.9%). The lowest percentage of compliance is for Road Surface, with 45.2%.

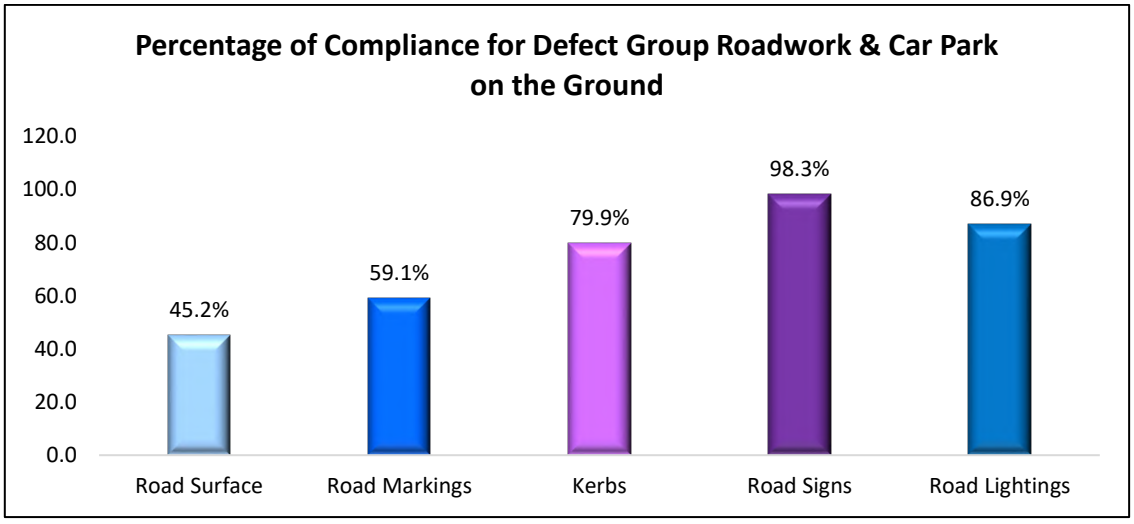


Figure 4.58: Percentage of Compliance for Defect Group Roadwork & Car Park on the Ground (2017).

Figure 4.59 shows the percentage of compliance for defect group, Footpath & Turfing. The highest percentage of compliance is 100.0% for Lighting, followed by Fixtures (97.7%). The lowest percentage of compliance is for Footpath 1, with 72.4%.

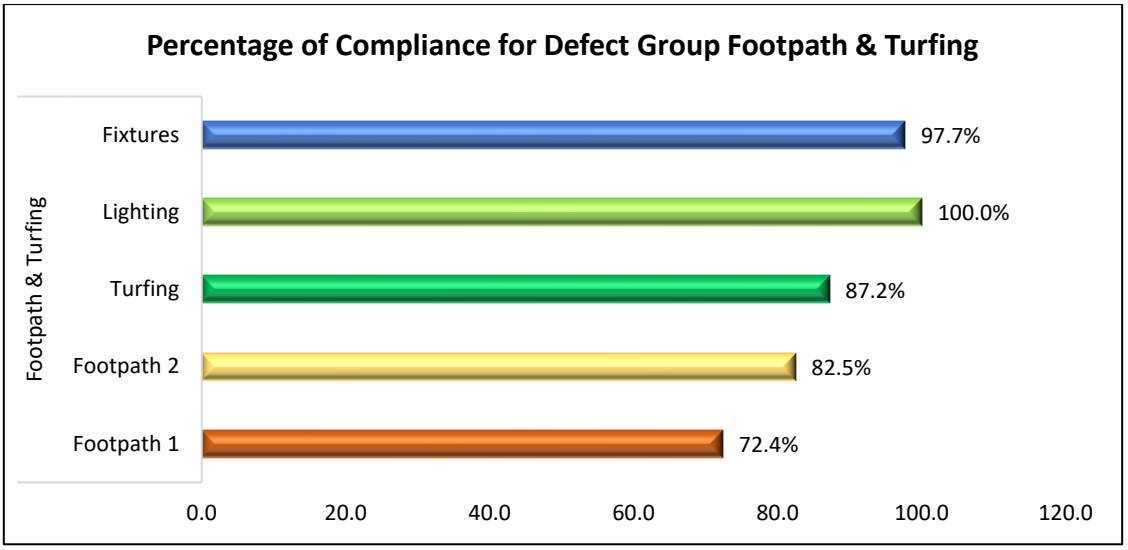


Figure 4.59: Percentage of Compliance for Defect Group Footpath & Turfing (2017).

Figure 4.60 shows the percentage of compliance for defect group, Playground. The highest percentage of compliance is 100.0% for Side Drain, followed by Playground Equipment and Lightings (97.2%). The lowest percentage of compliance is for Floor with 58.1%.

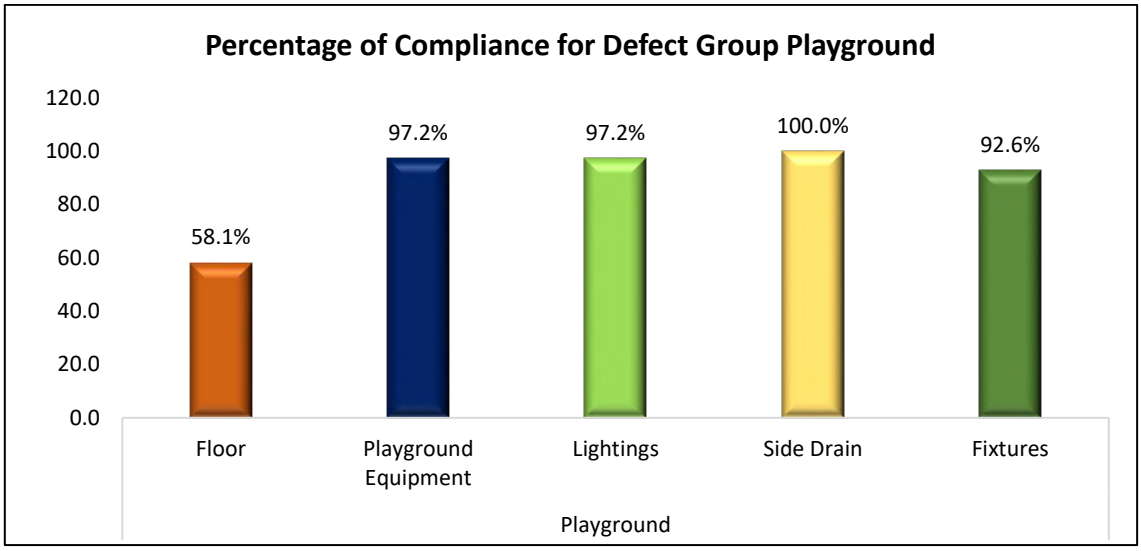


Figure 4.60: Percentage of Compliance for Defect Group Playground (2017).

Figure 4.61 shows the percentage of compliance for defect group, Court. The highest percentage of compliance is 100.0% for Signages and Basic M&E Fittings. The lowest percentage of compliance is for Floor 2, with 43.8%.

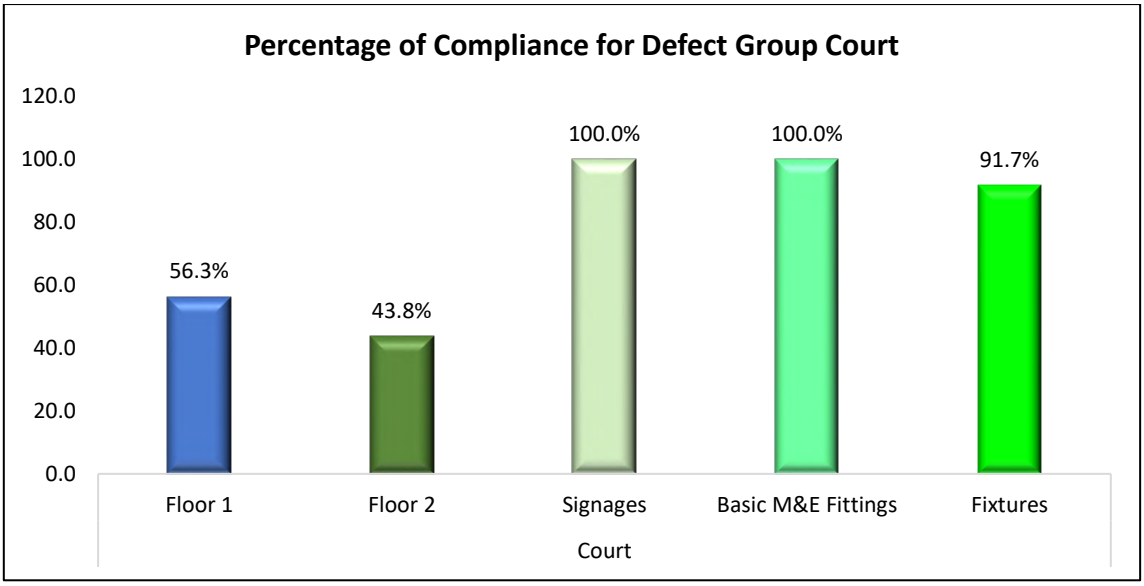


Figure 4.61: Percentage of Compliance for Defect Group Court (2017).

Figure 4.62 shows the percentage of compliance for defect group, Fencing & Gate. The highest percentage of compliance is 92.7% for Fixtures, followed by Basic M&E Fittings (90.8%). The lowest percentage of compliance is for Fence 1 with 49.7%.

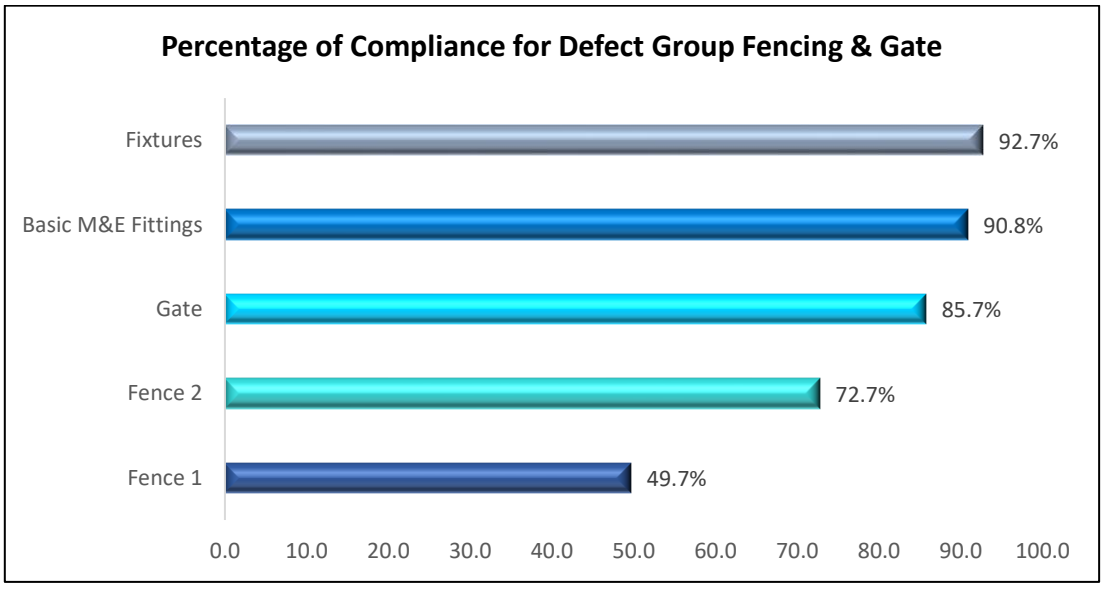


Figure 4.62: Percentage of Compliance for Defect Group Fencing & Gate (2017).

Figure 4.63 shows the percentage of compliance for defect group, Swimming Pool. The highest percentage of compliance is 100.0% for Basic M&E Fittings followed by Overflow Drain (96.3%). The lowest percentage of compliance is for Pool deck with 58.3%.

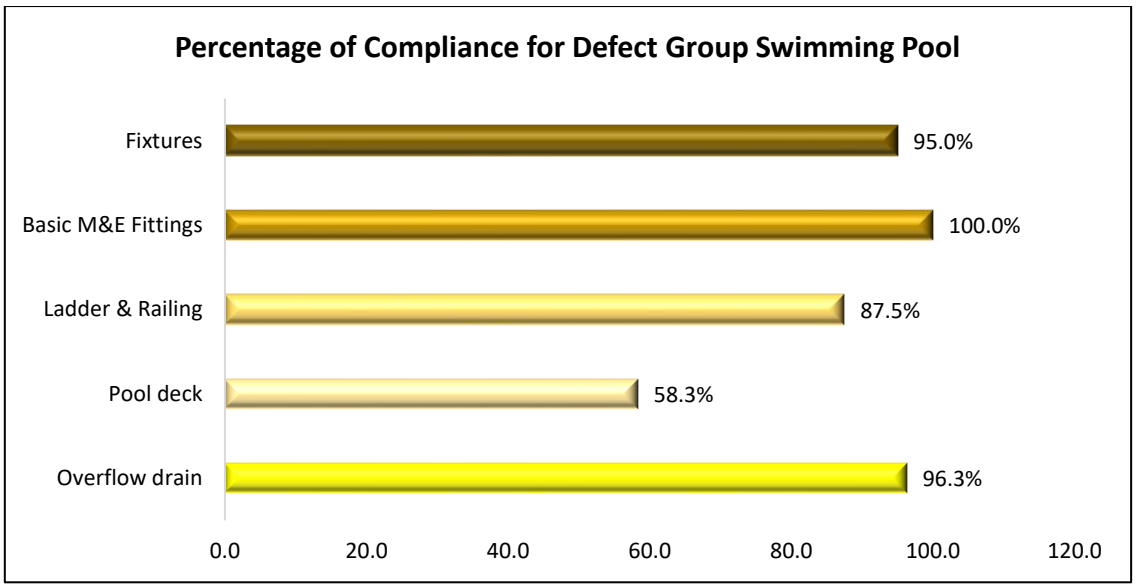


Figure 4.63: Percentage of Compliance for Defect Group Swimming Pool (2017).

Figure 4.64 shows the percentage of compliance for defect group, Electrical Substation. The highest percentage of compliance is 91.4% for Window, followed by Fence & Gate (78.3%). The lowest percentage of compliance is for External Wall with 37.9%.

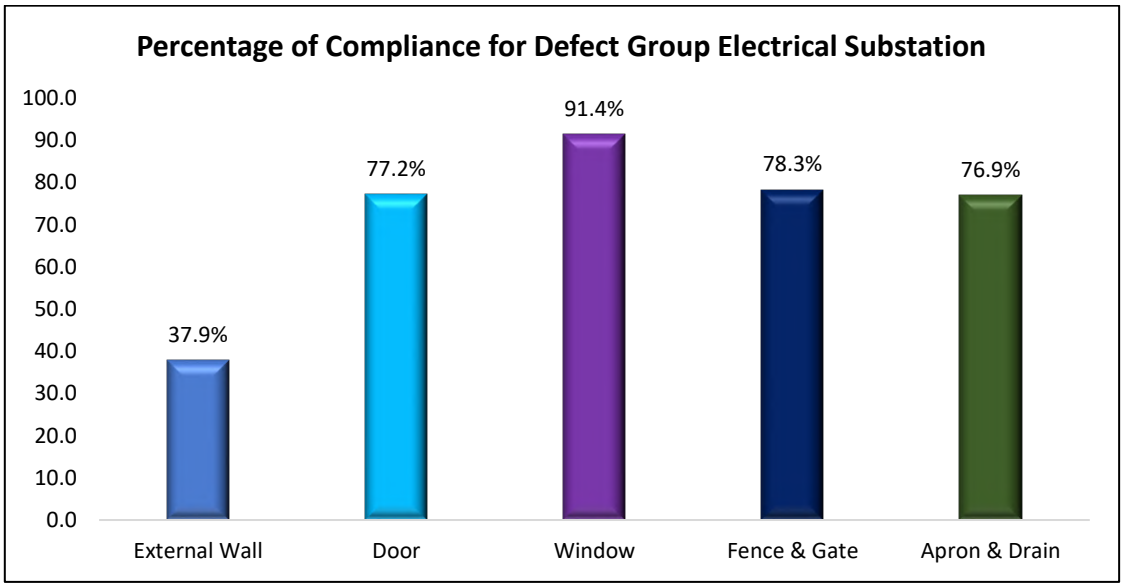


Figure 4.64: Percentage of Compliance for Defect Group Electrical Substation (2017).

Figure 4.65 shows the percentage of compliance for defect group, Basic M&E Fittings. The highest percentage of compliance is 98.3% for Alignment & Evenness, followed by Accessories Defects (95.8%). The lowest percentage of compliance is for Joints & Gaps, with 68.4%.

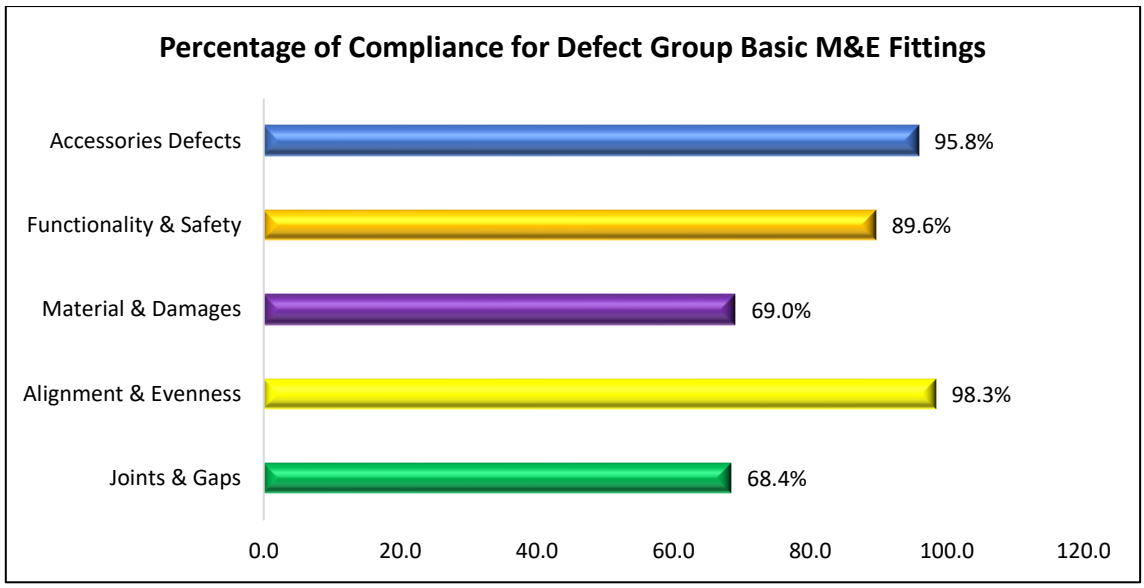


Figure 4.65: Percentage of Compliance for Defect Group Basic M&E Fittings (2017).

D. 2018

Figure 4.66 shows the total number of assessed locations for 2018. The majority of assessed locations is represented by Principal, followed by Service and Circular.

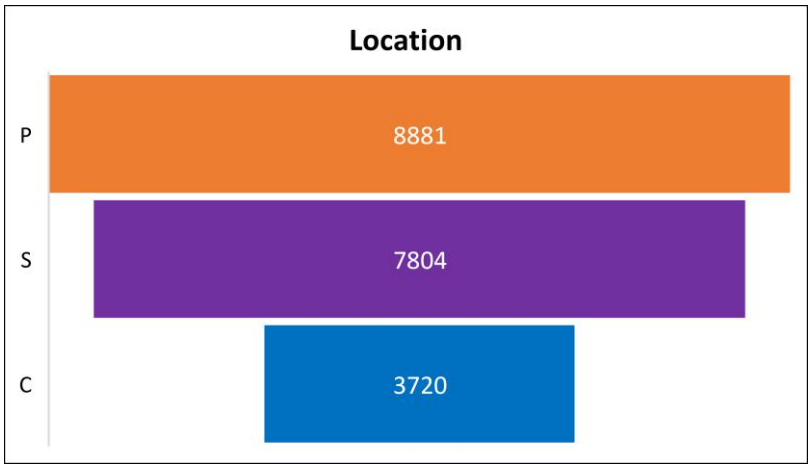


Figure 4.66: Total Number of Assessed Location (2018).

Figure 4.67 shows the percentage of compliance for defect group, Floor. The highest percentage of compliance is 99.5% for Alignment & Evenness, followed by Crack & Damages (96.2%). The lowest percentage of compliance is for Jointing, with 15.1%.

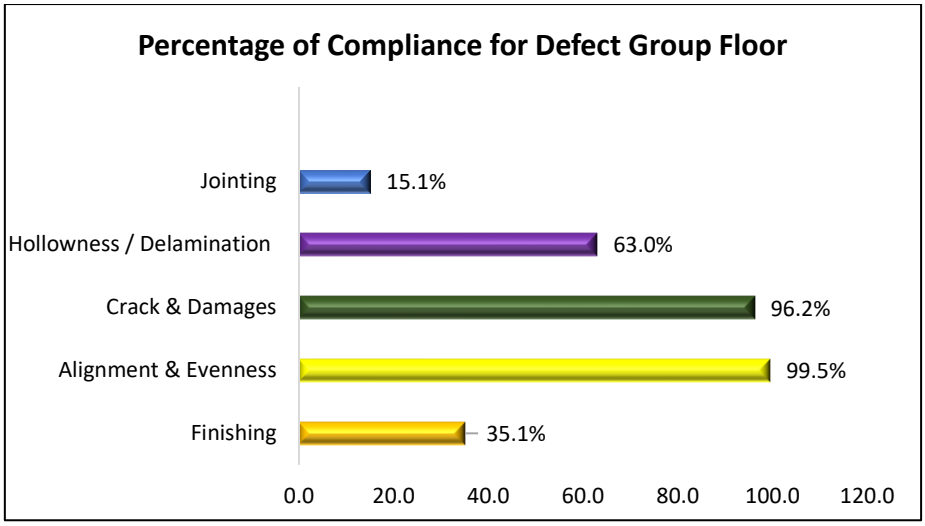


Figure 4.67: Percentage of Compliance for Defect Group Floor (2018).

Figure 4.68 shows the percentage of compliance for defect group, Basic Internal Wall. The highest percentage of compliance is 92.6% for Alignment & Evenness, followed by Crack & Damages (88.5%). The lowest percentage of compliance is for Finishing with 29.0%.

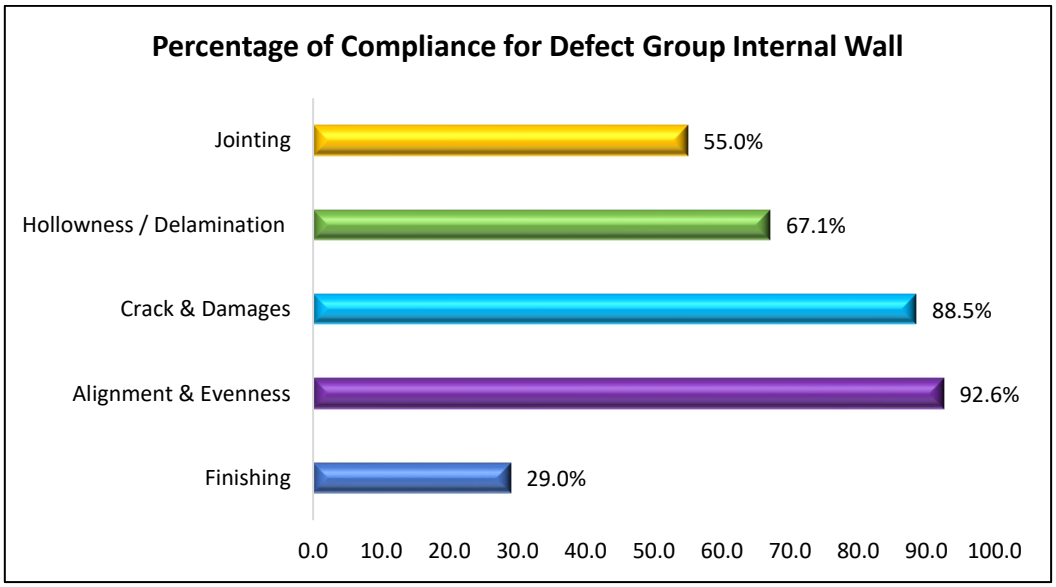


Figure 4.68: Percentage of Compliance for Defect Group Internal Wall (2018).

Figure 4.69 shows the percentage of compliance for defect group, Ceiling. The highest percentage of compliance is 99.1% for Hollowness/Delamination, followed by Alignment & Evenness (98.2%). The lowest percentage of compliance is for Finishing at 35.9%.

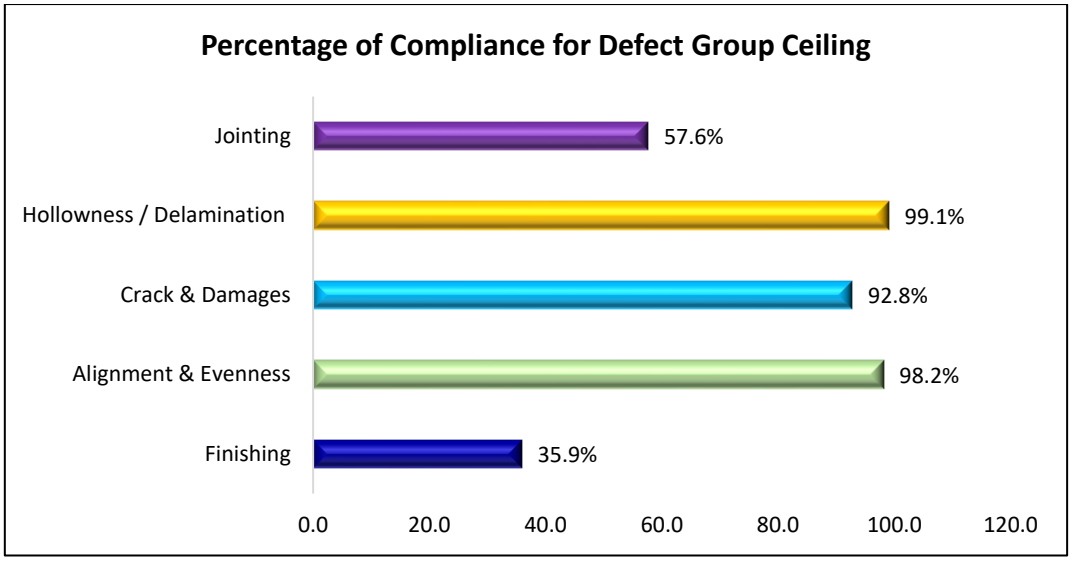


Figure 4.69: Percentage of Compliance for Defect Group Ceiling (2018).

Figure 4.70 shows the percentage of compliance for defect group, Door. The highest percentage of compliance is 98.5% for Functionality, followed by Alignment & Evenness (95.0%). The lowest percentage of compliance is for Material & Damages with 36.4%.

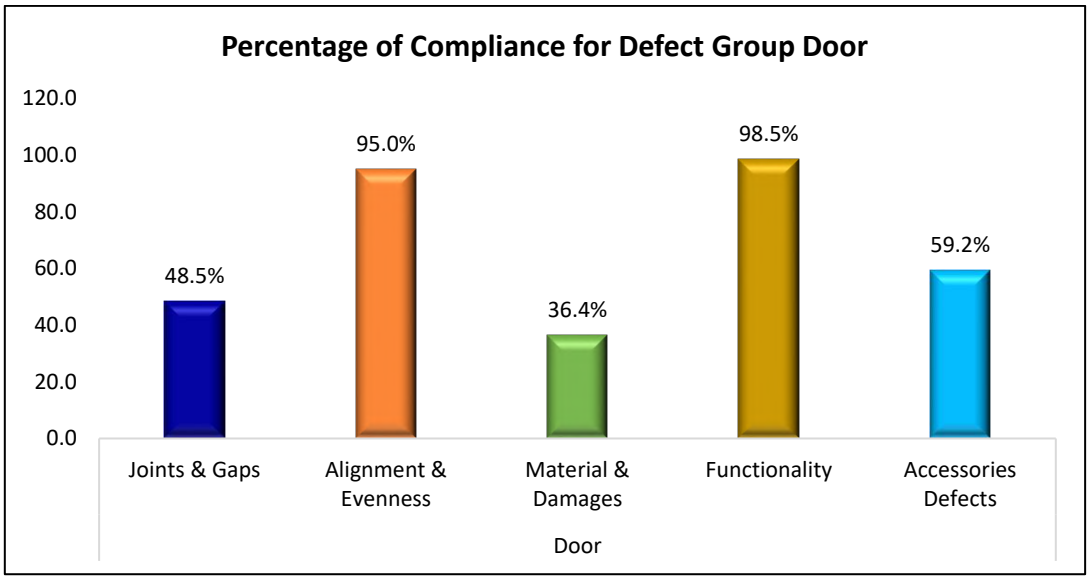


Figure 4.70: Percentage of Compliance for Defect Group Door (2018).

Figure 4.71 shows the percentage of compliance for defect group, Window. The highest percentage of compliance is 99.0% for Functionality, followed by Alignment & Evenness (98.8%). The lowest percentage of compliance is for Material & Damages with 25.9%.

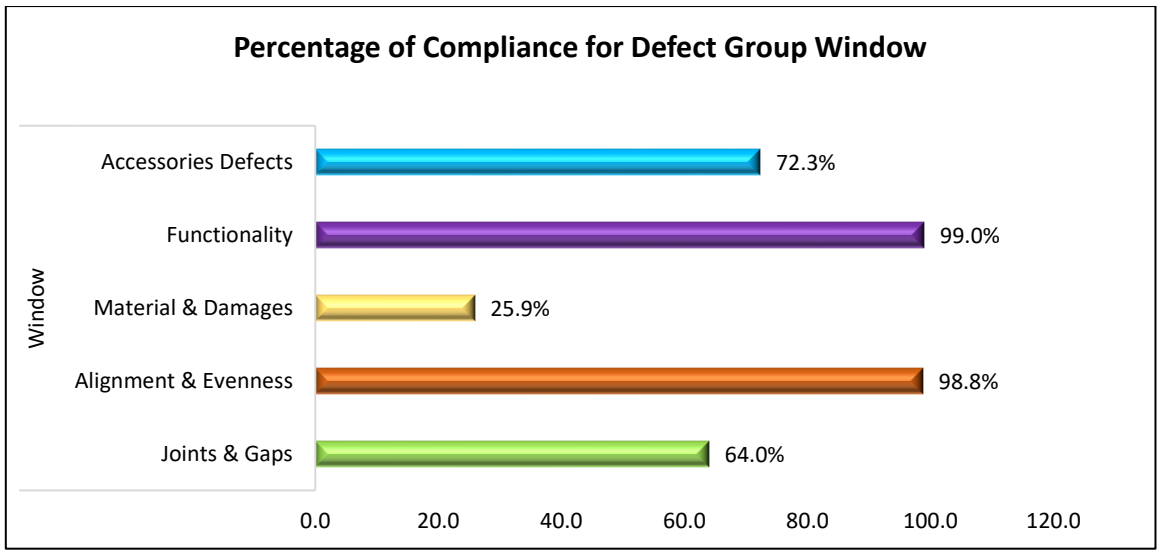


Figure 4.71: Percentage of Compliance for Defect Group Window (2018).

Figure 4.72 shows the percentage of compliance for defect group, Internal Fixtures. The highest percentage of compliance is 99.8% for Functionality, followed by Alignment & Evenness (97.7%). The lowest percentage of compliance is for Material & Damages with 67.2%.

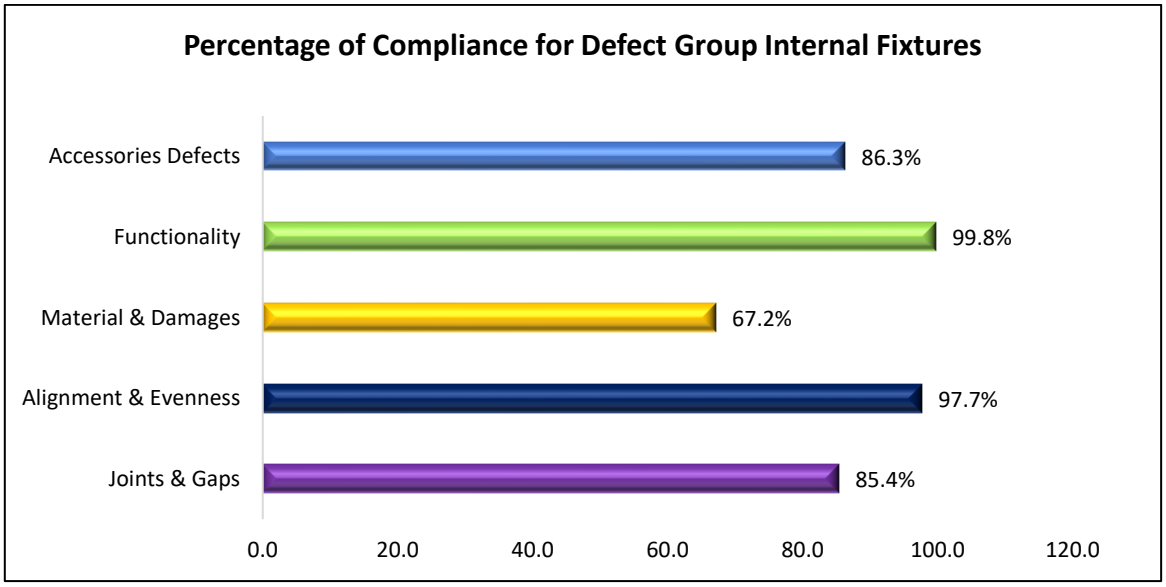


Figure 4.72: Percentage of Compliance for Defect Group Internal Fixtures (2018).

Figure 4.73 shows the percentage of compliance for defect group, Roof. The highest percentage of compliance is 93.9% for Chokage/Ponding, followed by Crack & Damages (93.8%). The lowest percentage of compliance is for Finishing at 54.0%.

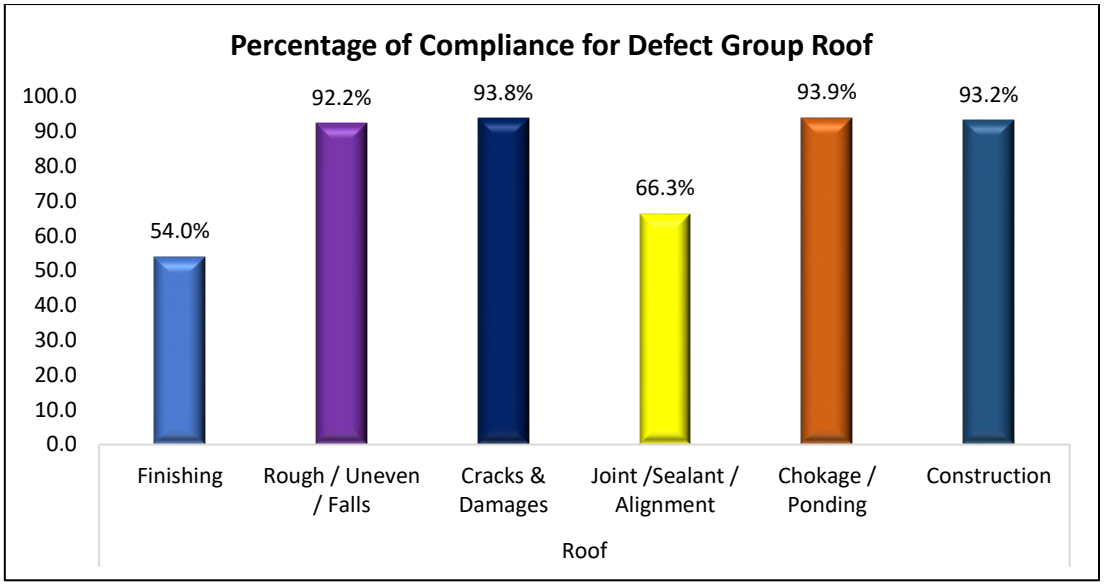


Figure 4.73: Percentage of Compliance for Defect Group Roof (2018).

Figure 4.74 shows the percentage of compliance for defect group, Basic External Wall. The highest percentage of compliance is 97.2% for Alignment & Evenness, followed by Jointing (93.3%). The lowest percentage of compliance is for Finishing at 23.1%.

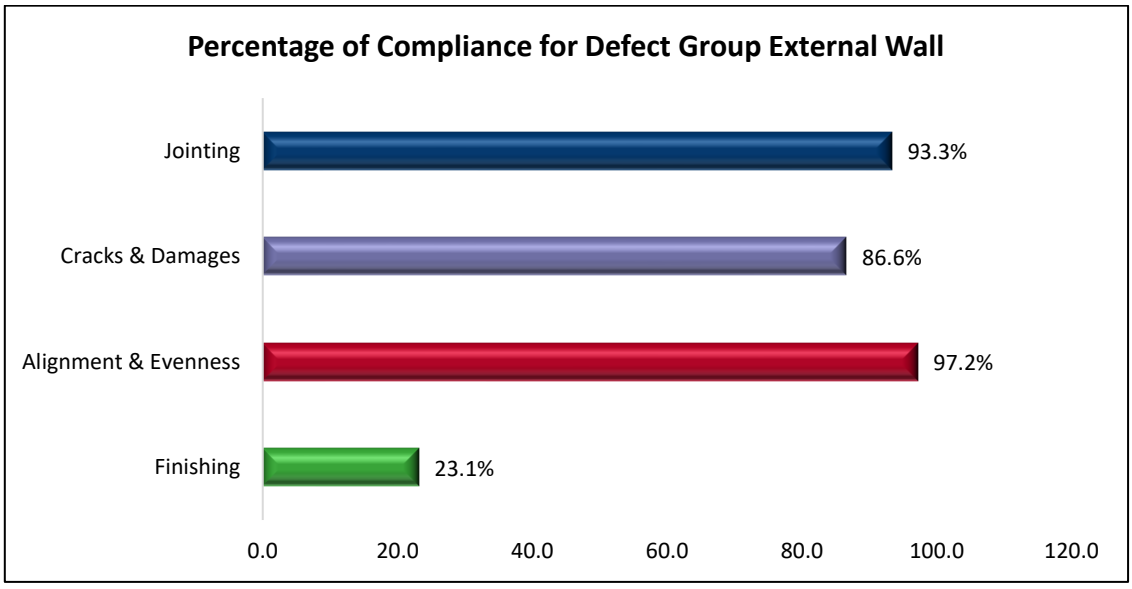


Figure 4.74: Percentage of Compliance for Defect Group External Wall (2018).

Figure 4.75 shows the percentage of compliance for defect group, Apron & Perimeter. The highest percentage of compliance is 94.3% for Inspection Chamber followed by Drain Cover (89.4%). The lowest percentage of compliance is for Drain with 57.7%.

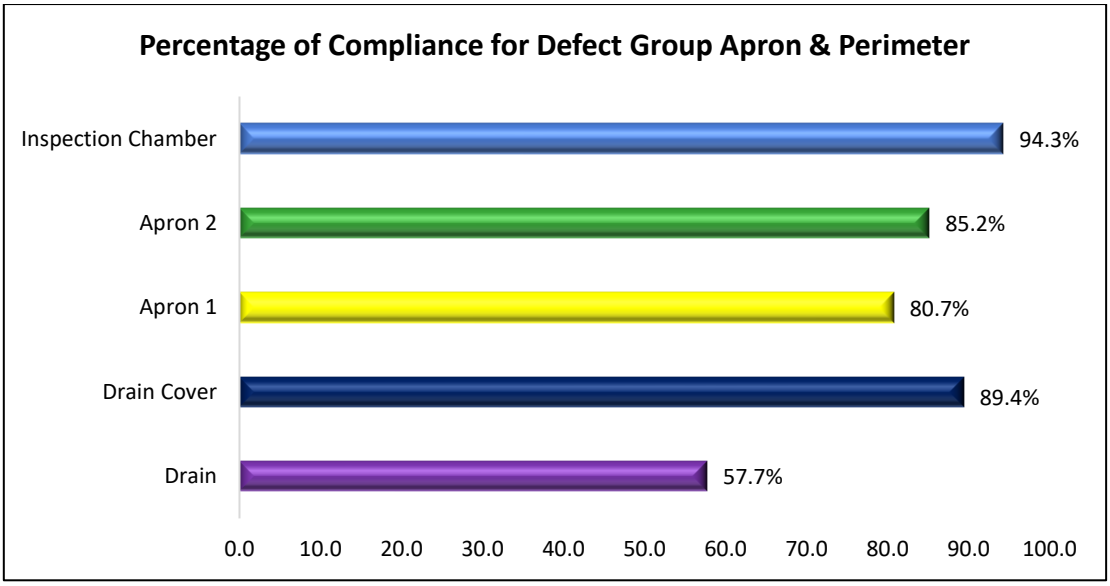


Figure 4.75: Percentage of Compliance for Defect Group Apron & Perimeter (2018).

Figure 4.76 shows the percentage of compliance for defect group, Car Park/Car Porch. The highest percentage of compliance is 97.3% for Fixtures, followed by Basic M&E Fittings (93.8%). The lowest percentage of compliance is for Floor with 18.5%.

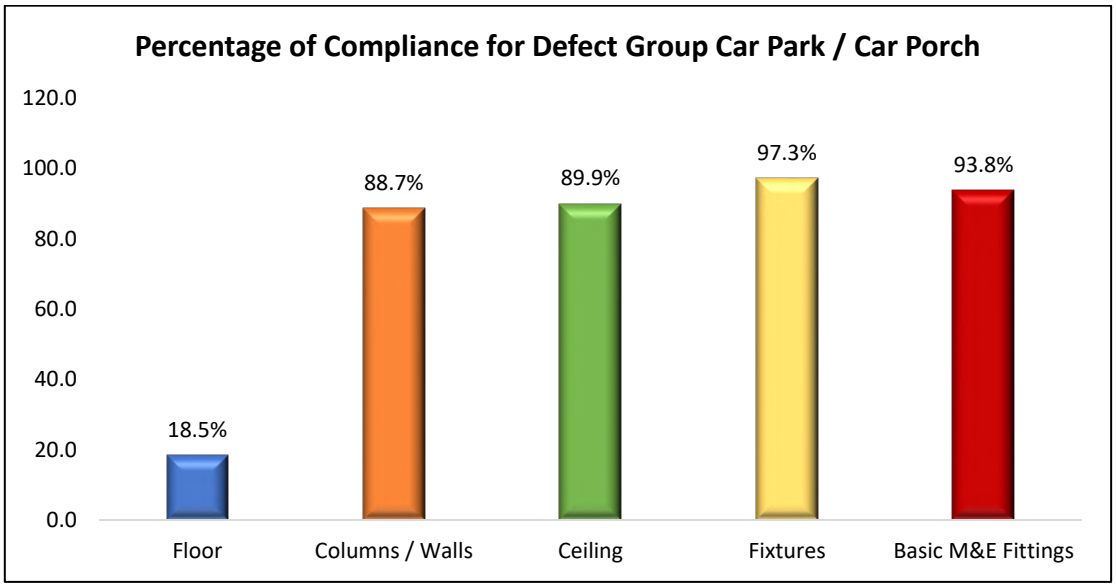


Figure 4.76: Percentage of Compliance for Defect Group Car Park/Car Porch (2018).

Figure 4.77 shows the percentage of compliance for defect group, Link-way/Shelter. The highest percentage of compliance is 100.0% for Columns, followed by Basic M&E Fittings (94.4%). The lowest percentage of compliance is for Floor with 63.0%.

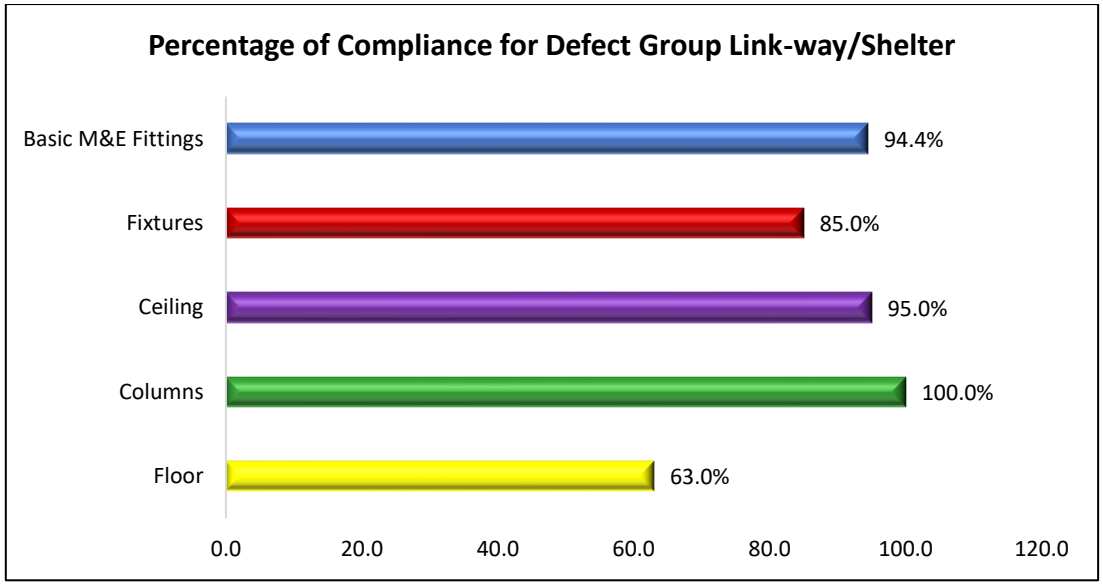


Figure 4.77: Percentage of Compliance for Defect Group Lin-way/Shelter (2018).

Figure 4.78 shows the percentage of compliance for defect group, External Drain. The highest percentage of compliance is 97.9% for Inspection Chamber followed by Drain Cover 2 (92.5%). The lowest percentage of compliance is for Drain 1 with 42.6%.

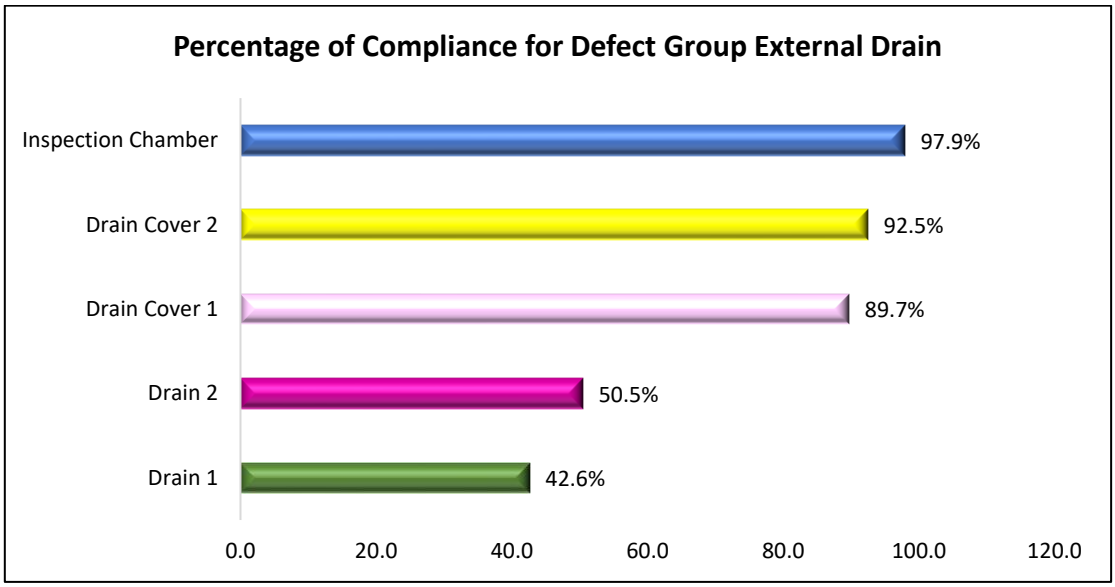


Figure 4.78: Percentage of Compliance for Defect Group External Drain (2018).

Figure 4.79 shows the percentage of compliance for defect group, Roadwork & Car Park on the Ground. The highest percentage of compliance is 97.7% for Road Signs, followed by Road Lightings (96.4%). The lowest percentage of compliance is for Kerbs, with 40.8%.

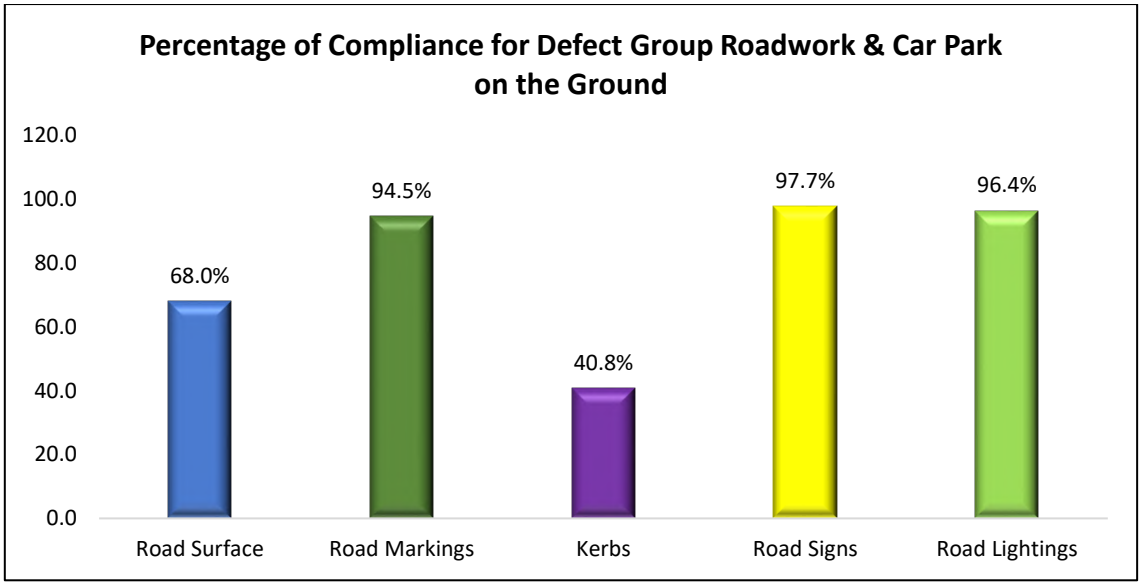


Figure 4.79: Percentage of Compliance for Defect Group Roadwork & Car Park (2018).

Figure 4.80 shows the percentage of compliance for defect group, Footpath & Turfing. The highest percentage of compliance is 98.9% for Lighting, followed by Footpath 2 (92.3%). The lowest percentage of compliance is for Footpath 1, with 85.7%.

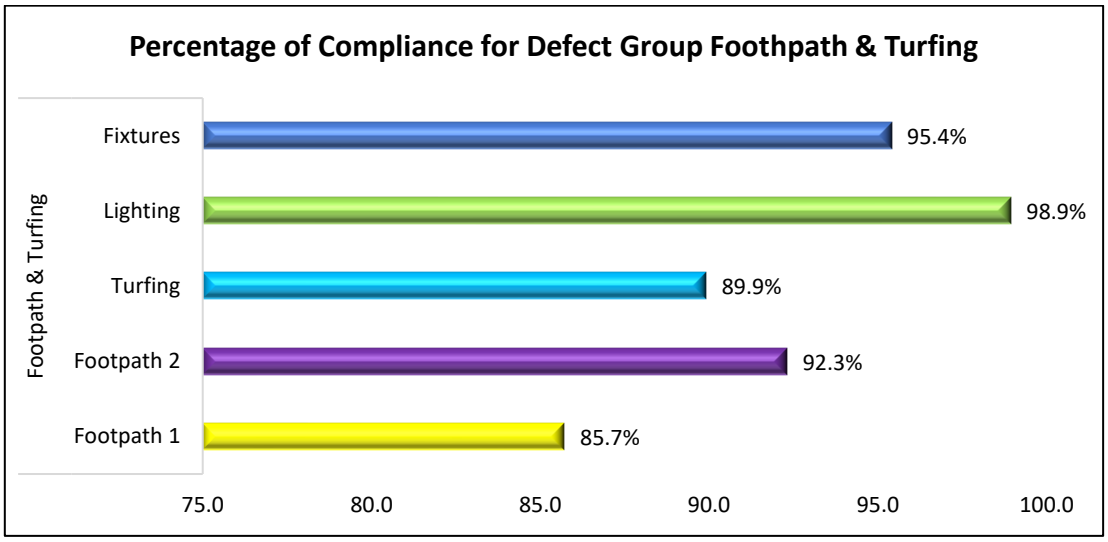


Figure 4.80: Percentage of Compliance for Defect Group Footpath & Turfing (2018).

Figure 4.81 shows the percentage of compliance for defect group, Playground. Most of the defect groups achieved high compliance with 100.0% for Playground Equipment, Lightings, and Fixtures. The lowest percentage of compliance is for Floor with 55.0%.

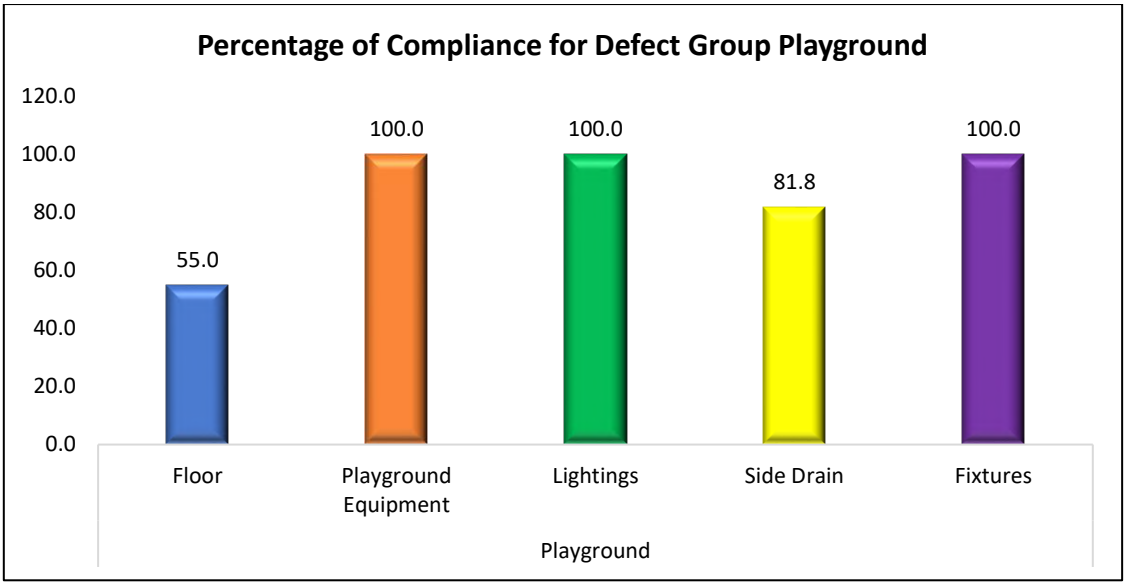


Figure 4.81: Percentage of Compliance for Defect Group Playground (2018).

Figure 4.82 shows the percentage of compliance for defect group, Court. Most of the defect groups achieved high compliance with 100.0% for Floor 1, Basic M&E Fittings and Fixtures. The lowest percentage of compliance is for Signages, with 50.0%.

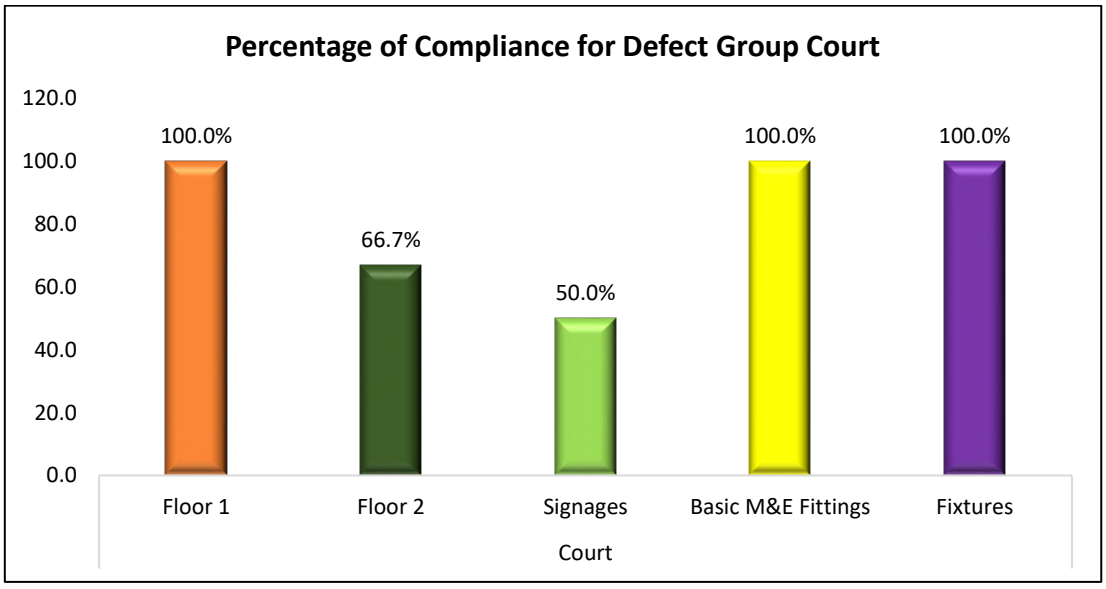


Figure 4.82: Percentage of Compliance for Defect Group Court (2018).

Figure 4.83 shows the percentage of compliance for defect group, Fencing & Gate. The highest percentage of compliance is 95.8% for Fence 2, followed by Basic M&E Fittings (95.2%). The lowest percentage of compliance is for Fence 1 with 85.2%.

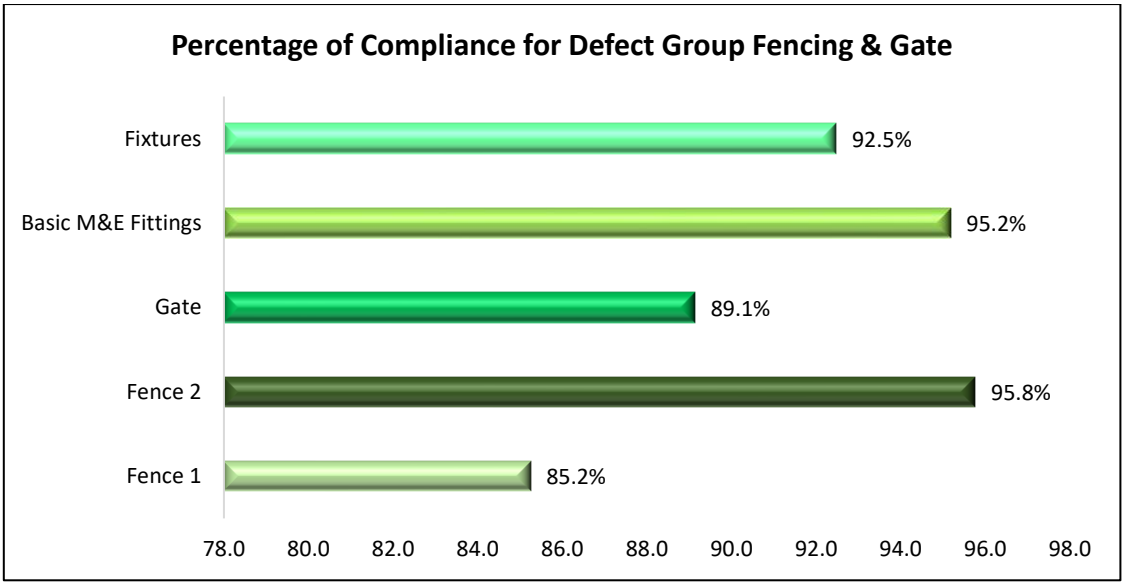


Figure 4.83: Percentage of Compliance for Defect Group Fencing & Gate (2018).

Figure 4.84 shows the percentage of compliance for defect group, Swimming Pool. The highest percentage of compliance is 100.0% for Basic M&E Fittings, and Ladder & Railing followed by Overflow Drain (90.0%). The lowest percentage of compliance is for Fixtures with 80.0%.

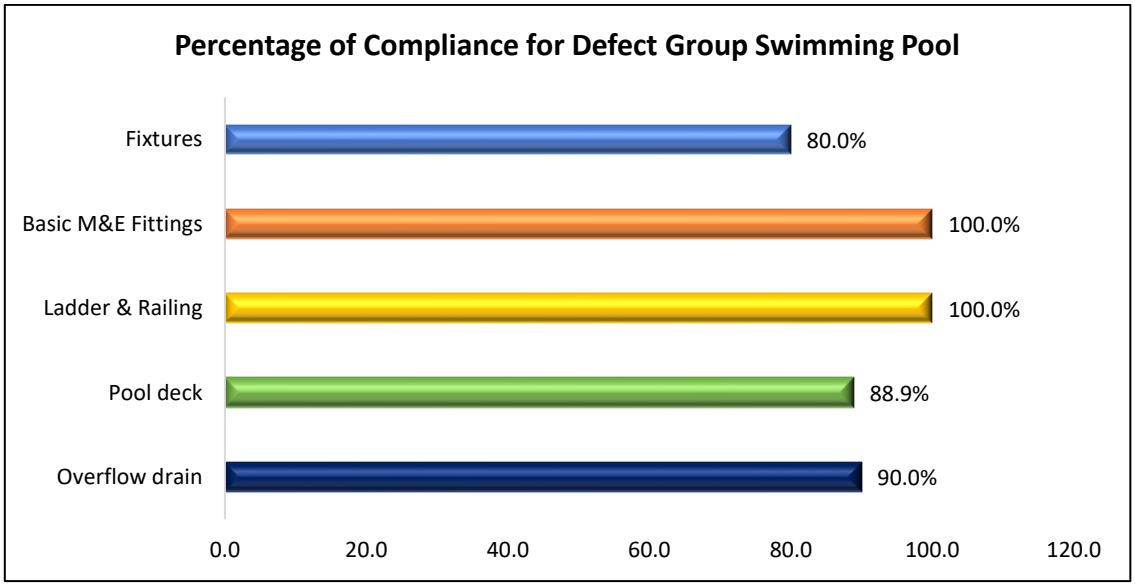


Figure 4.84: Percentage of Compliance for Defect Group Swimming Pool (2018).

Figure 4.85 shows the percentage of compliance for defect group, Electrical Substation. The highest percentage of compliance is 98.0% for Window, followed by Door (76.8%). The lowest percentage of compliance is for External Wall with 29.8%.

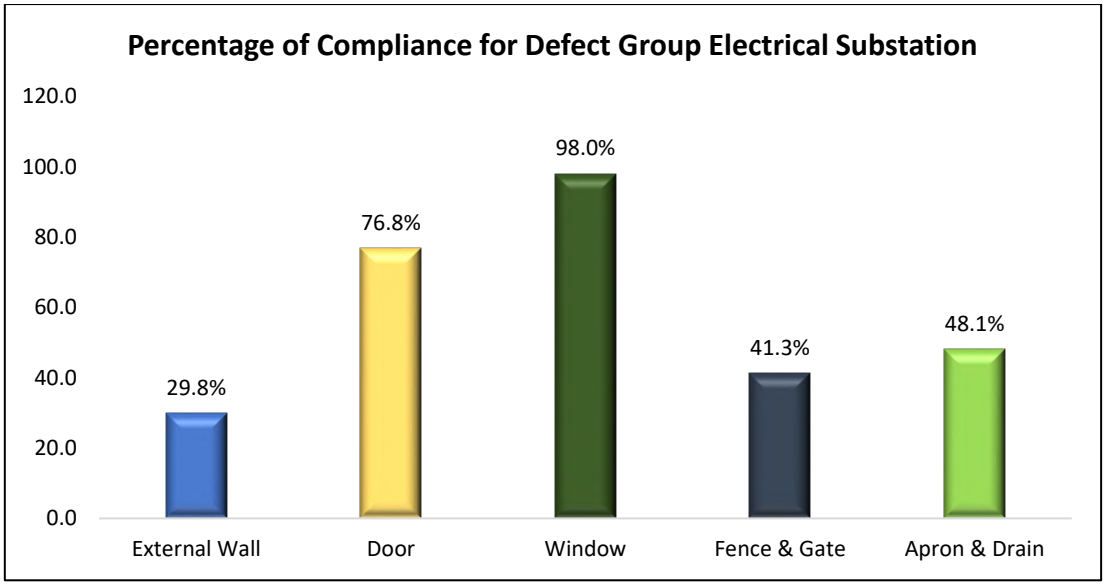


Figure 4.85: Percentage of Compliance for Defect Group Electrical Substation (2018).

Figure 4.86 shows the percentage of compliance for defect group, Guard House. The highest percentage of compliance is 100.0% for Barrier and Roof, followed by Door & Window (93.8%). The lowest percentage of compliance is for External Wall with 56.3%.

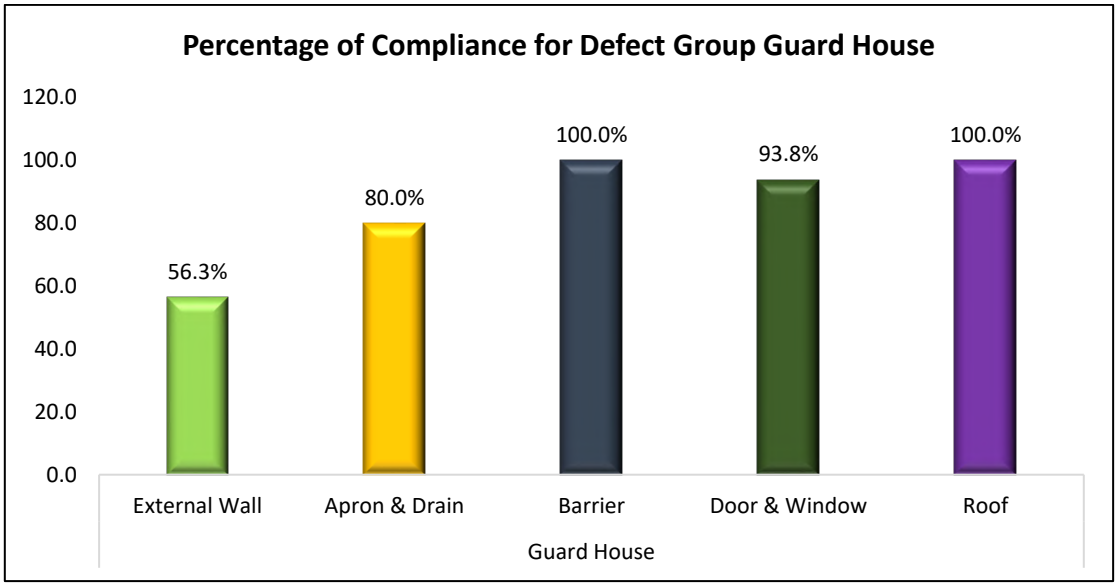


Figure 4.86: Percentage of Compliance for Defect Group Guard House (2018)

Figure 4.87 shows the percentage of compliance for defect group, Bin Centre. The highest percentage of compliance is 94.6% for Apron & Drain, followed by Roof (90.6%). The lowest percentage of compliance is for External Wall with 51.2%.

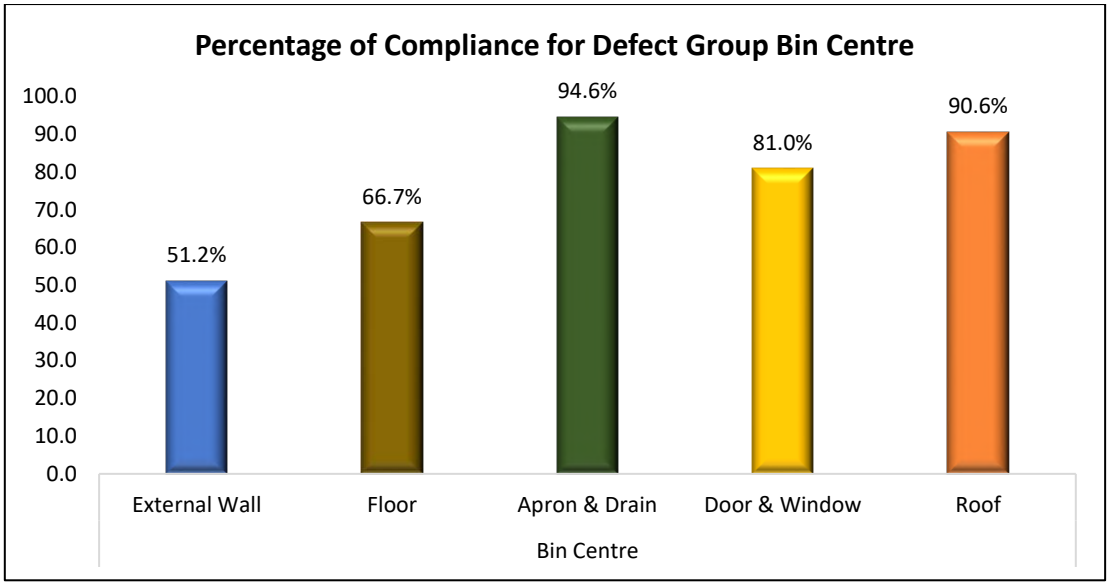


Figure 4.87: Percentage of Compliance for Defect Group Bin Centre (2018).

Figure 4.88 shows the percentage of compliance for defect group, Basic M&E Fittings. The highest percentage of compliance is 99.8% for Functionality, followed by Alignment & Evenness (98.4%). The lowest percentage of compliance is for Joints & Gaps, with 57.5%.

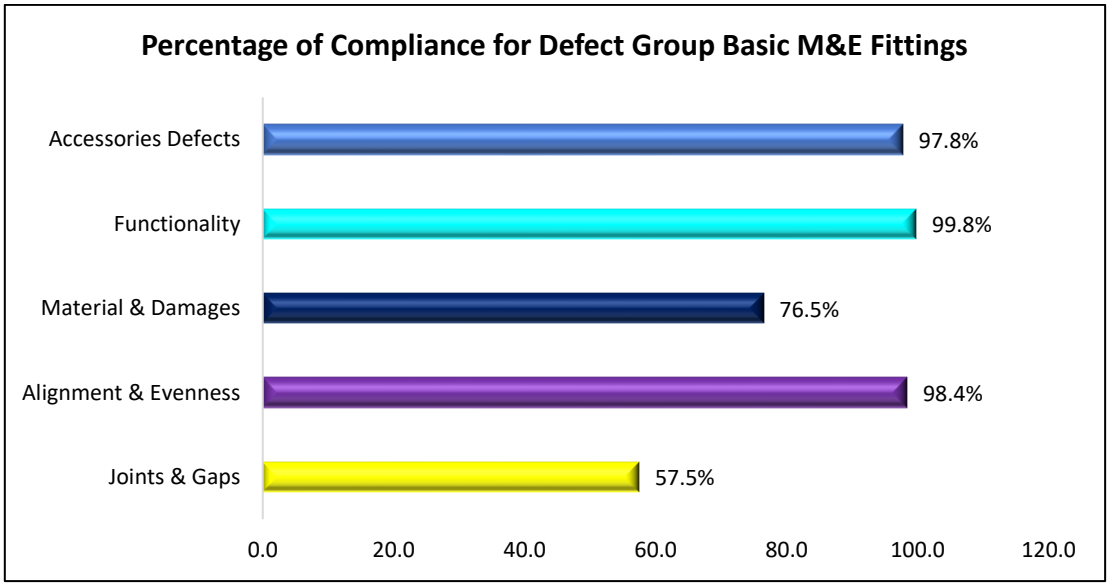


Figure 4.88: Percentage of Compliance for Defect Group Basic M&E Fittings (2018).

Summary

Table 4.1 below displays the lowest defect group relating to compliance for the period between 2015 and 2018. Most of the elements display the same highest defect group

for these periods such as Finishing for Floor, Internal Wall, Ceiling, Roof and External Wall. Likewise, Element Door, Window and Internal Fixtures also show the same defect group, which is Material & Damages. Element Apron & Perimeter Drain and External Drain which share the same defect group, which is Drain the said period. The element of Basic M&E Fittings also has the same highest defect group, which is Joints & Gaps.

Table 4.1: Summary of the Highest Defect Group.

Element	Defect Group (Highest)			
	2015	2016	2017	2018
Floor	Finishing	Finishing	Finishing	Jointing
Internal Wall	Finishing	Finishing	Finishing	Finishing
Ceiling	Finishing	Finishing	Finishing	Finishing
Door	Material & Damages	Material & Damages	Material & Damages	Material & Damages
Window	Material & Damages	Material & Damages	Material & Damages	Material & Damages
Internal Fixtures	Material & Damages	Material & Damages	Functionality	Material & Damages
Roof	Finishing	Finishing	Finishing	Finishing
External Wall	Finishing	Finishing	Finishing	Finishing
Apron & Perimeter Drain	Drain	Drain	Drain	Drain
Car Park/Car Porch	Basic M&E Fittings	-	Floor	Floor
Link-way/ Shelter	Floor	Floor	Floor	Floor
External Drain	Drain	Drain	Drain	Drain
Roadwork & Car Park on the ground	Road Markings	Road Surface	Road Surface	Kerbs
Footpath & Turfing	Footpath 1	Footpath 1	Footpath 1	Footpath 1
Playground	Floor	Floor	Floor	Floor
Court	Floor 2	Floor 1	Floor 2	Signages
Fencing & Gate	Fence 1	Fence 1	Fence 1	Fence 1
Swimming Pool	Overflow Drain	Pool deck Overflow Drain	Pool deck	Fixtures
Electrical Substation	External Wall	External Wall	External Wall	External Wall
Guard House	Roof	-	-	External Wall
Bin Centre	External Wall	-	-	External Wall
Basic M&E Fittings	Joints & Gaps	Joints & Gaps	Joints & Gaps	Joints & Gaps

4.2. Analysis on QLASSIC Scoring

A. Number of QLASSIC Project

The total number of QLASSIC projects between 2015 and 2018 was 887 incorporating Categories A, B, C and D. In 2015, 82 projects had undergone the QLASSIC assessment: 45 projects in Category A, 11 projects in Category B, 24 projects in Category C and two projects in Category D. In 2016, there were 248 projects assessed by QLASSIC: Category A (136 projects), Category B (47 projects), Category C (63 projects) and Category D (2 projects.)

In 2017, a sum of 303 projects was undertaken with the majority assessed in Category A (164 projects), and 76 projects in Category C. Category B contributed around 62 projects while Category D only had one project. In 2018, the total number of projects assessed by QLASSIC was around 254 projects where Category A was represented with 121 projects, Category B (70 projects), Category C (45 projects) and Category D (18 projects).

Table 4.2: Number of QLASSIC Projects between 2015 and 2018.

Year	Category	Total
2015	A	45
	B	11
	C	24
	D	2
TOTAL 2015		**82**
2016	A	136
	B	47
	C	63
	D	2
TOTAL 2016		**248**
2017	A	164
	B	62
	C	76
	D	1
TOTAL 2016		**303**
2018	A	121
	B	70
	C	45
	D	18
TOTAL 2018		**254**

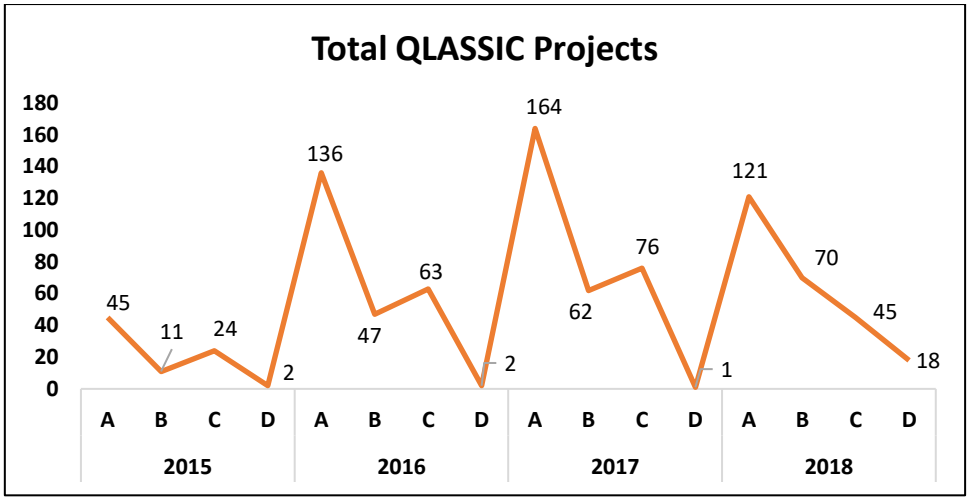


Figure 4.89: Number of QLASSIC Projects (2015-2018).

B. QLASSIC Scores in 2015

Figure 4.90 displays the QLASSIC scores for 2015 for Categories A, B, C and D. As can be seen from observing the figure, the scores between 21 and 30 only represented one project in Category D. The majority of scores range between 71 and 80 followed by scores between 61 and 70. Two categories (A & C) recorded scores between 81 and 90, with a small minority of scores between 51 and 60.

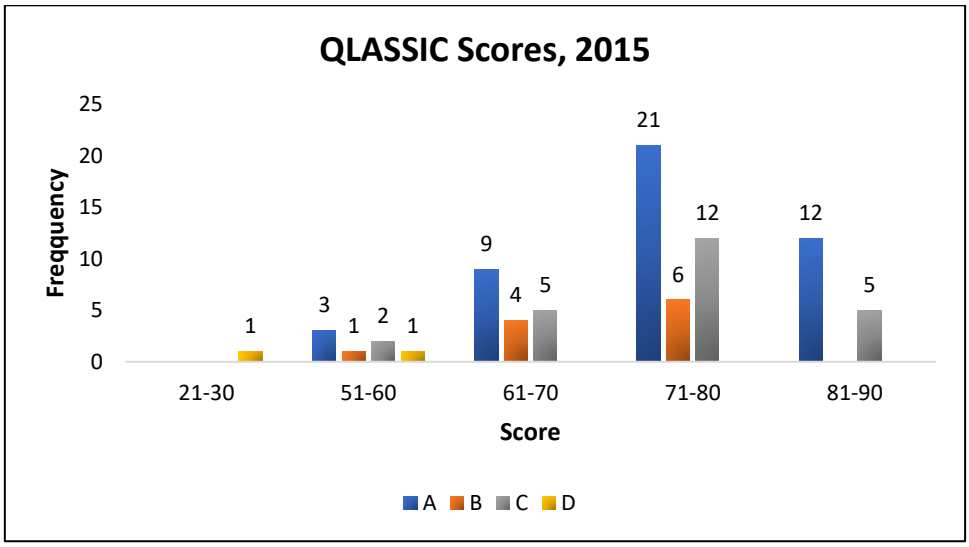


Figure 4.90: QLASSIC Scores for all Categories in 2015.

Category A

Figure 4.91 shows the range of QLASSIC scores in Category A for 2015. Most projects scored between 71 and 80 (21 projects) followed by 12 projects that scored between 81 and 90.

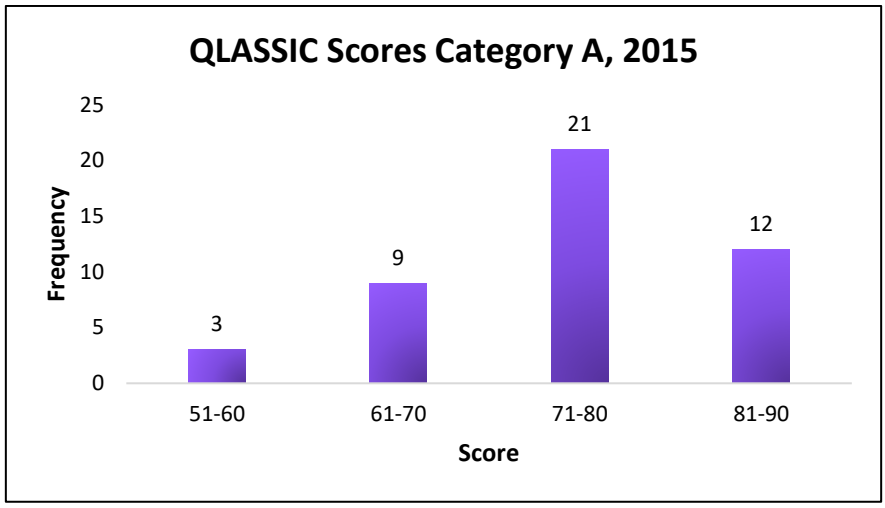


Figure 4.91: QLASSIC Scores in Category A for 2015.

Category B

Figure 4.92 shows the QLASSIC scores in Category B for 2015. The majority of projects scored between 71 and 80 (6 projects) followed by four projects scoring between 61 and 70, with the least score attributed to only one project, with a score ranging between 51 and 60.

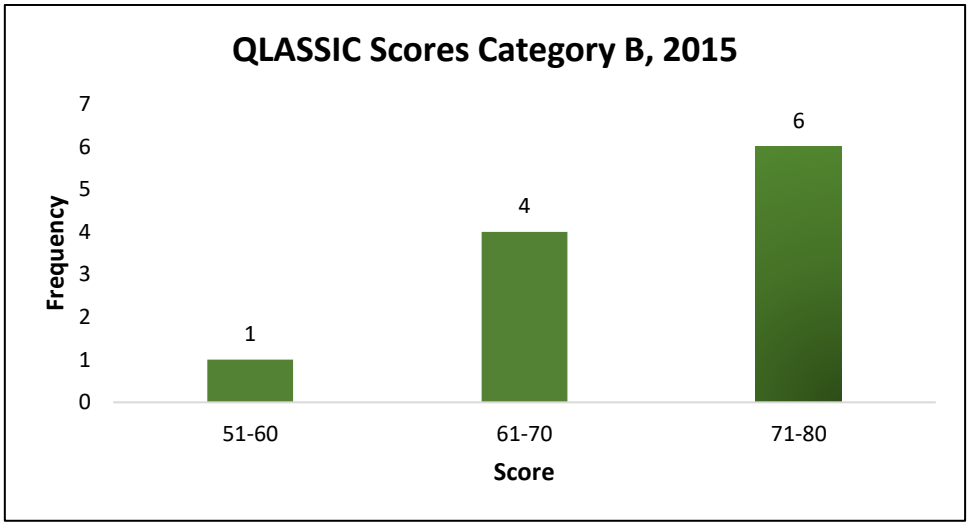


Figure 4.92: QLASSIC Scores in Category B for 2015.

Category C

Figure 4.93 shows the QLASSIC scores in Category C for 2015. The majority (12 projects) scored between 71 and 80, five projects scoring between 61 and 70, and between 81 and 90 respectively. The least QLASSIC score is seen, ranging between 51 and 60 represented by two projects.

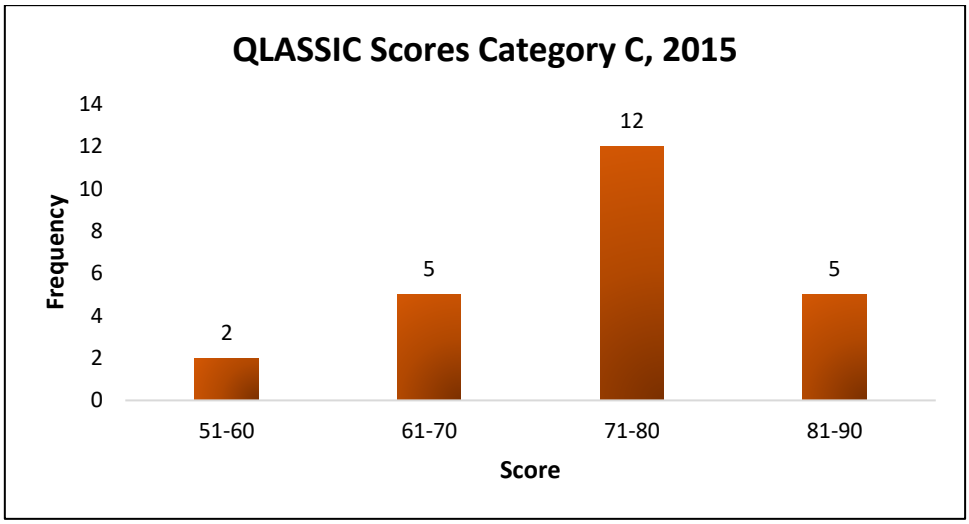


Figure 4.93: QLASSIC Scores in Category C for 2015.

Category D

Figure 4.94 shows the QLASSIC scores in Category D for 2015. One project is recorded for each score between 21 and 30 and between 51 and 60.

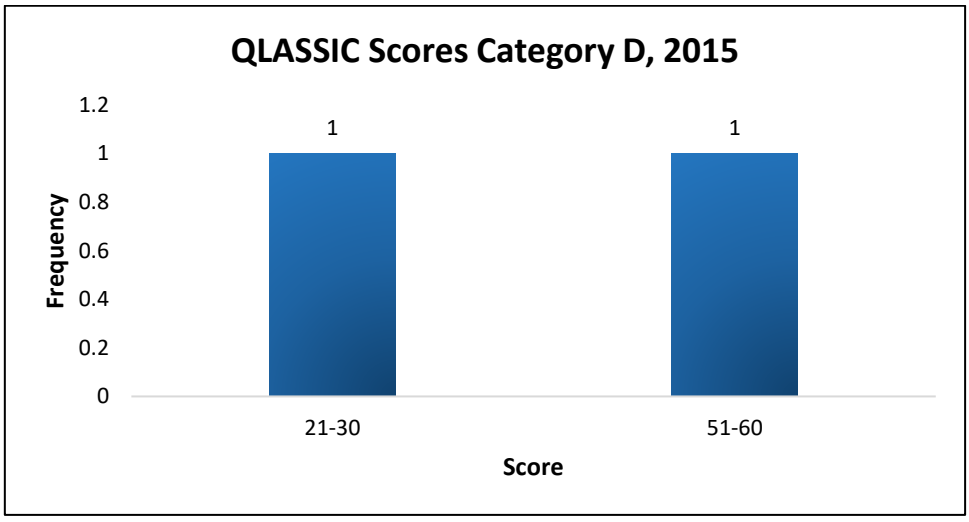


Figure 4.94: QLASSIC Scores in Category D for 2015.

C. QLASSIC Scores in 2016

Figure 4.95 shows the QLASSIC scores for all categories for 2016. Most of the projects scored between 71 and 80, followed by a score between 61 and 70. A score between 81 and 90 was represented by Categories A, B and C with the minority of projects scoring between 51 and 60.

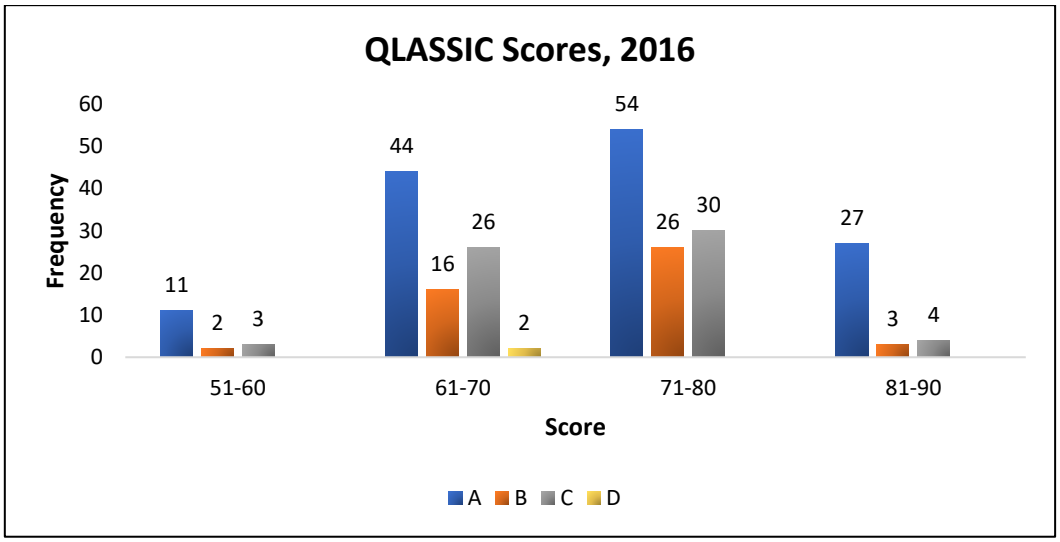


Figure 4.95: QLASSIC Scores for all Category in 2016

Category A

Figure 4.96 shows the QLASSIC scores in Category A for 2016. Here, 54 projects are assessed with the QLASSIC scores ranging between 71 and 80, 44 projects scoring between 61 and 70, 20 projects scoring between 81 and 90, with the minority scoring between 51 and 60 (11 projects).

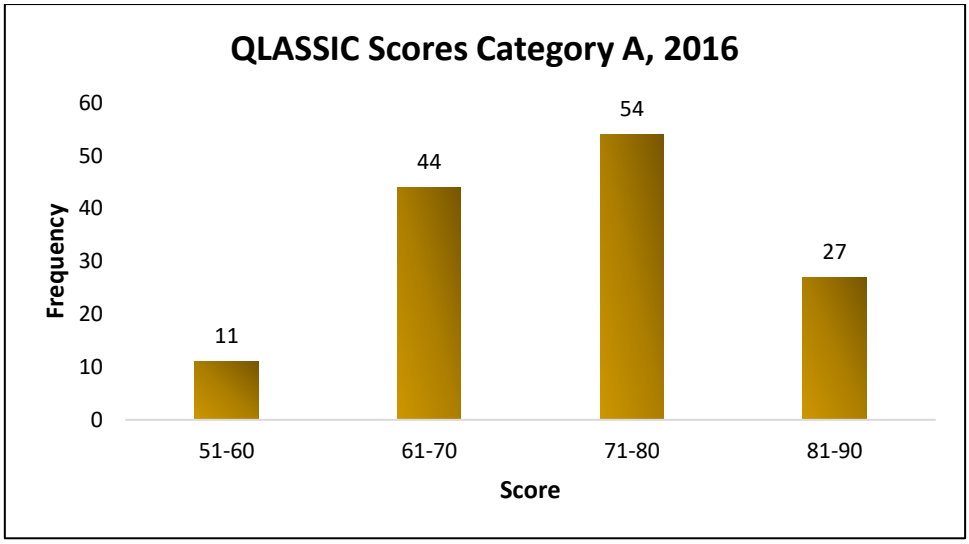


Figure 4.96: QLASSIC Scores in Category A for 2016

Category B

Category B in 2016 shows that most (26 projects) of the projects scored between 71 and 80, followed a score ranging between 61 and 70 with 16 projects. The least number of projects as can be seen in the figure below represented a score between 81 and 90 (3 projects) and a score between 51 and 60 with two projects.

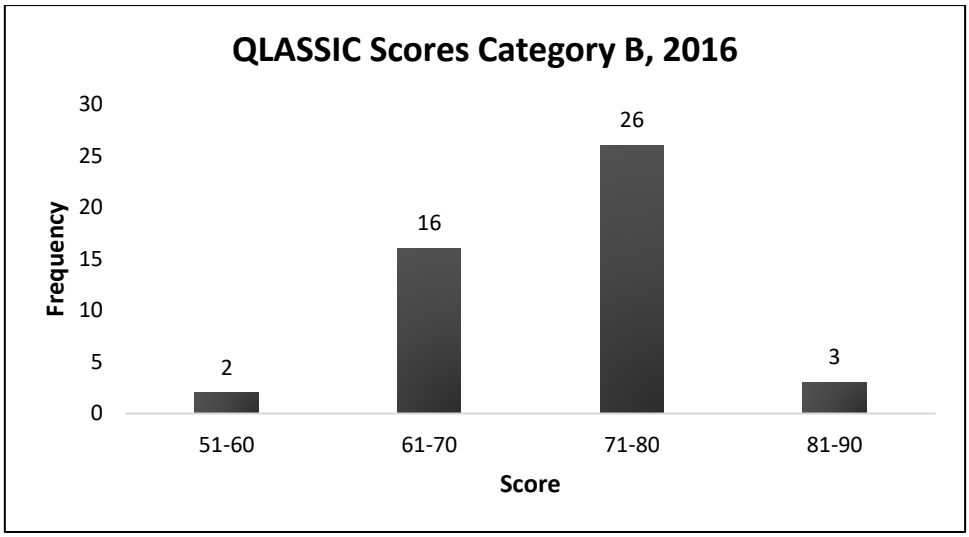


Figure 4.97: QLASSIC Scores in Category B for 2016

Category C

Figure 4.98 shows the QLASSIC scores in Category C for 2016. The scores range between 71 and 80 recorded the highest number of projects (30 projects), followed

by a score between 61 and 70 with 26 projects. A minority of projects scored between 81 and 90 (four projects) and three projects scoring between 51 and 60.

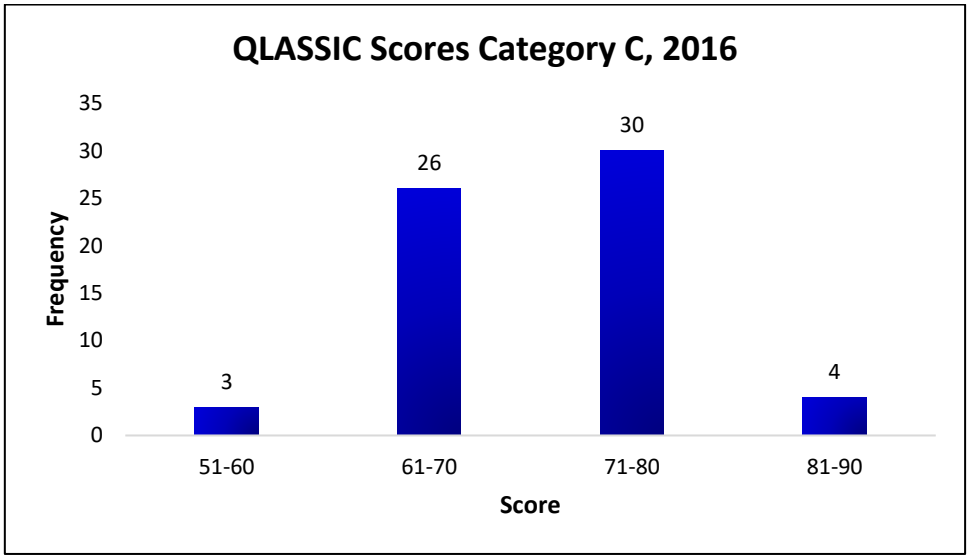


Figure 4.98: QLASSIC Scores in Category C for 2016

Category D

Figure 4.99 shows the QLASSIC scores in Category D for 2016. Only two projects were in Category D with a score ranging between 61 and 70.

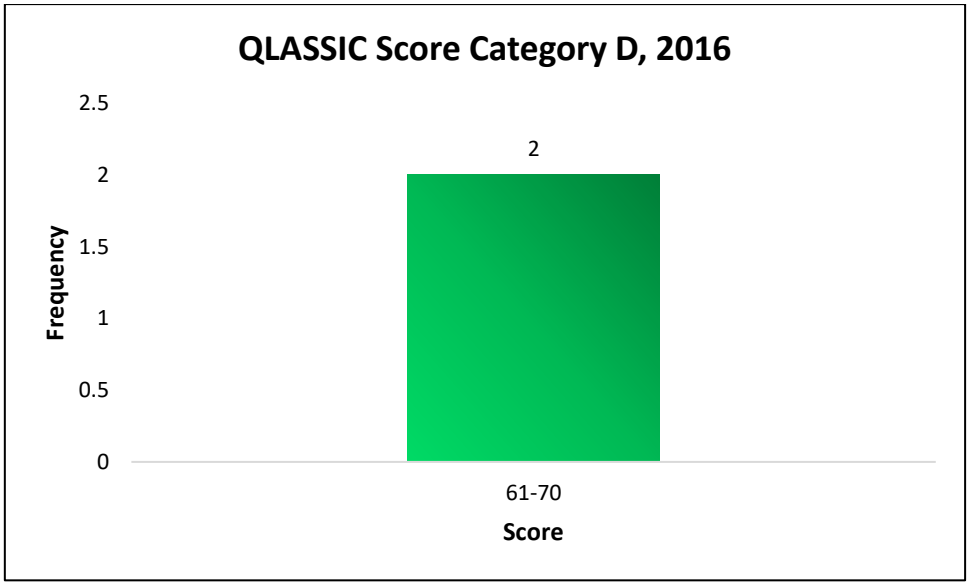


Figure 4.99: QLASSIC Score in Category D for 2016.

D. QLASSIC Scores in 2017

Figure 4.100 shows the QLASSIC scores for all categories in 2017. As seen from the figure, the majority of projects scored between 71 and 80, and between 61 and 70. This was followed by scores ranging between 81 and 90, with the least score between 51 and 60.

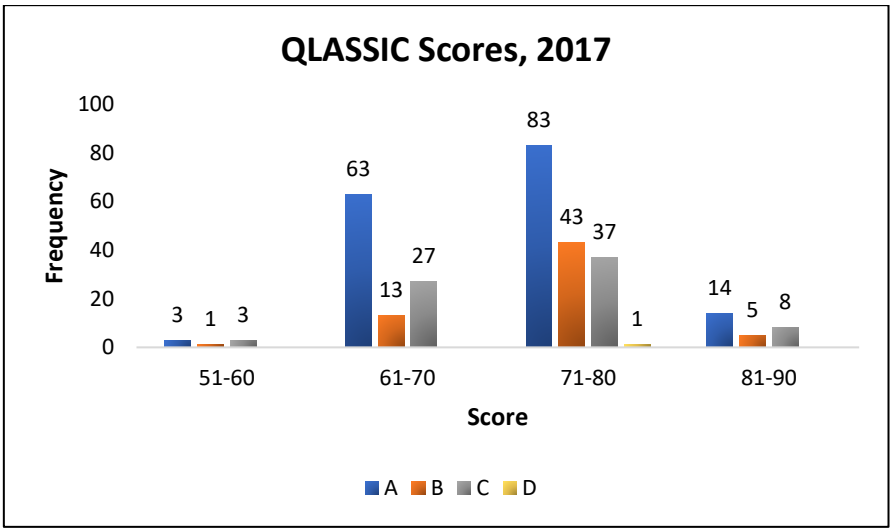


Figure 4.10: QLASSIC Scores for all Categories in 2017.

Category A

Figure 4.101 shows the QLASSIC scores in Category A for 2017. Most (83) of the projects scored between 71 and 80, followed by 63 projects scoring between 61 and 70. Fourteen (14) projects scored between 81 and 90 with the least number of projects (3) scoring between 51 and 60.

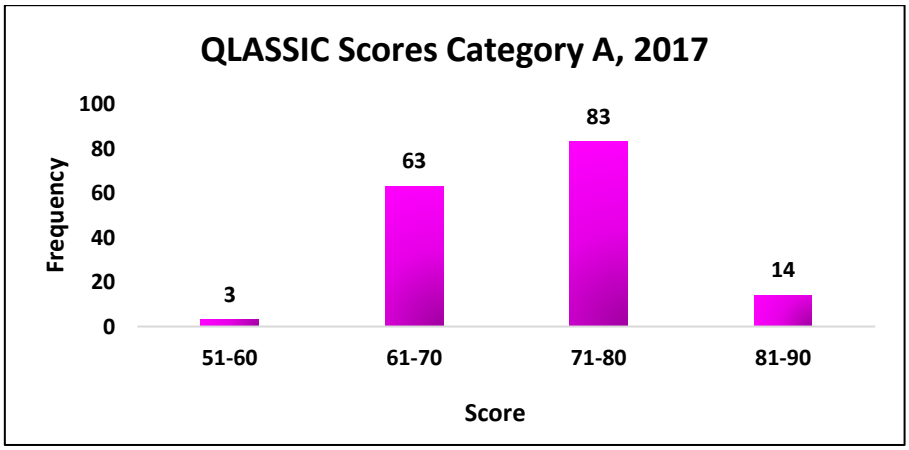


Figure 4.101: QLASSIC Scores in Category A for 2017.

Category B

QLASSIC scores in Category B for 2017, as shown in Figure 4.102, display the projects involved in QLASSIC assessments scoring between 71 and 80, while 13 projects scored between 61 and 70. Five projects scored between 81 and 90 with the least number of projects of one scoring between 51 and 60.

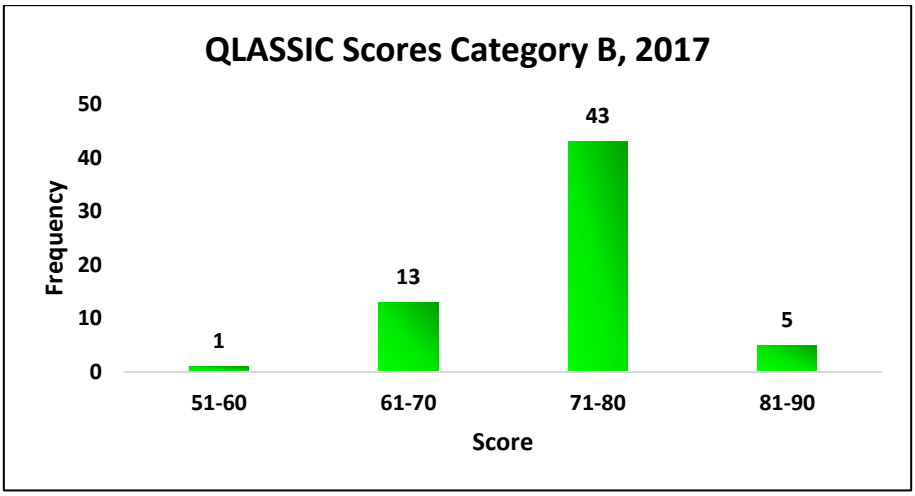


Figure 4.102: QLASSIC Scores in Category B for 2017.

Category C

Figure 4.103 shows the QLASSIC scores for Category C in 2017. Most (37) of the projects scored between 71 and 80 with 27 projects scoring between 61 and 70 and 8 projects scoring between 81 and 90, The minority of projects (3) scored between 51 and 60.

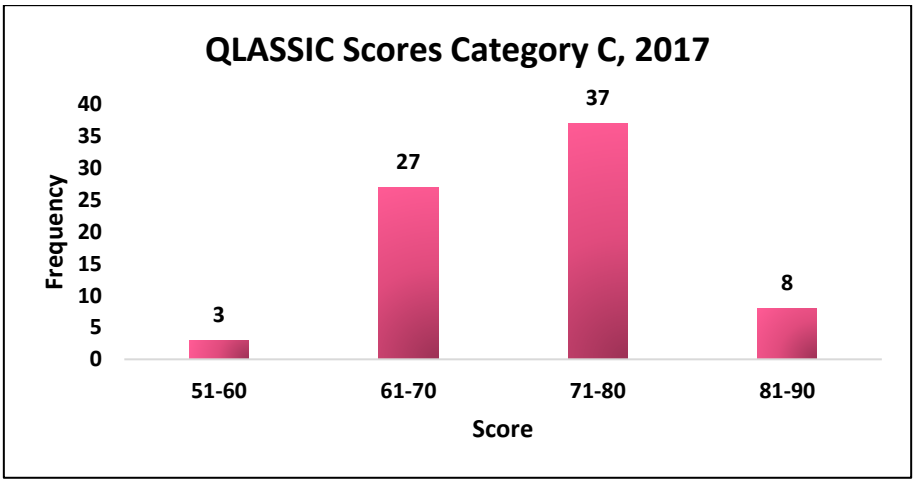


Figure 4.103: QLASSIC Scores in Category C for 2017.

Category D

The QLASSIC score in Category D for 2017 shows that for one project, the score ranged between 71 and 80.

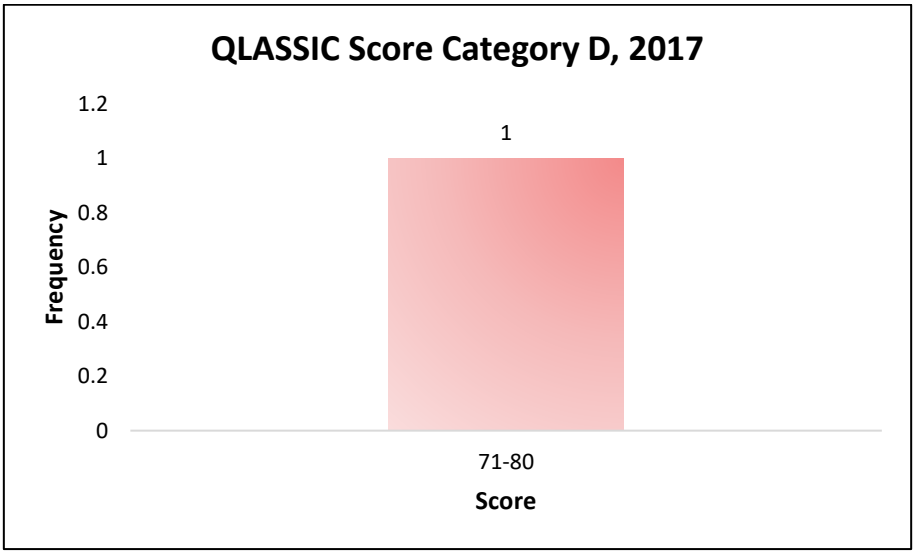


Figure 4.104: QLASSIC Score in Category D for 2017.

E. QLASSIC Scores in 2018

Figure 4.105 shows the QLASSIC scores for all categories in 2018. A score between 71 and 80 shows the highest number of projects, followed by a score between 61 and 70. A score between 81 and 90 shows the third-highest number of projects with the minority scoring between 51 and 60.

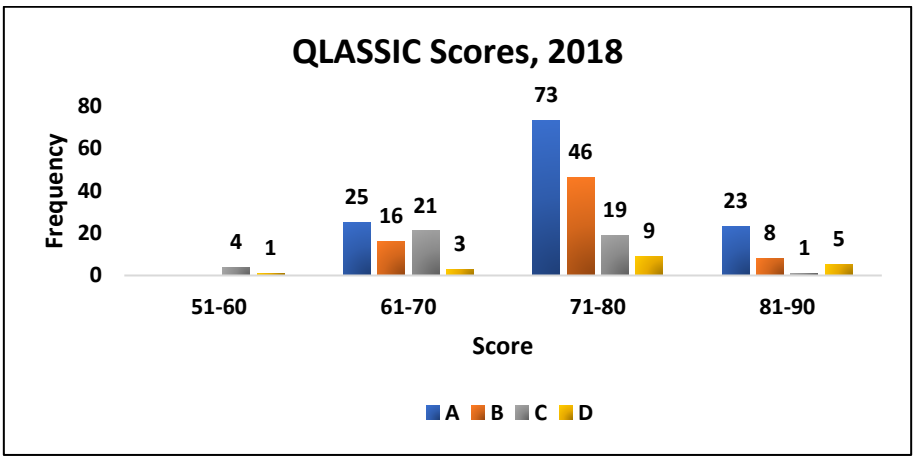


Figure 4.105: QLASSIC Scores for all Categories in 2018

Category A

The QLASSIC scores in Category A for 2018 indicate that the highest number of projects (73) scored between 71 and 80, followed by scoring between 61 and 70 with 25 projects. The least number of projects (23) scored between 81 and 90.

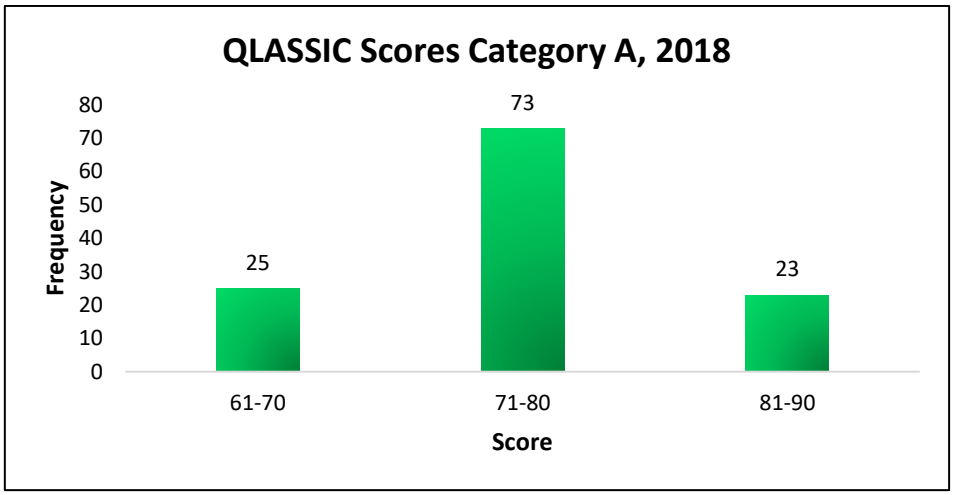


Figure 4.106: QLASSIC Scores for Category A in 2018

Category B

Figure 4.107 shows the QLASSIC scores in Category B for 2018. Forty-six (46) projects had the highest score for the number of projects ranging between 71 and 80 followed by 16 projects scoring between 61 and 70 with the least number of projects scoring between 81 and 90 (8 projects).

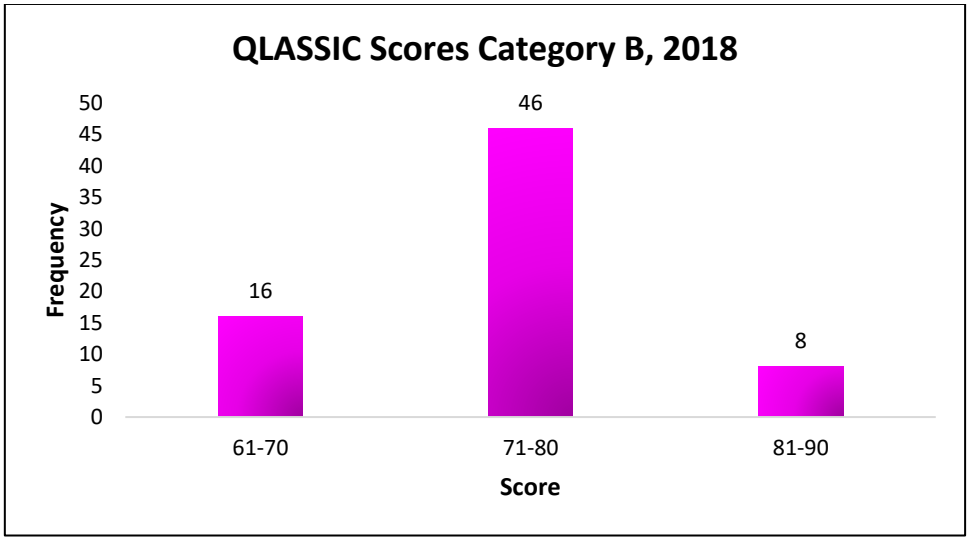


Figure 4.107: QLASSIC Scores for Category B in 2018

Category C

Figure 4.108 displays the QLASSIC scores for Category C in 2018. Twenty-one (21) projects scored between 61 and 70, followed by 19 projects scoring between 71 and 80. Four projects scored between 51 and 60, while the least score was between 81 and 90 represented by one project.

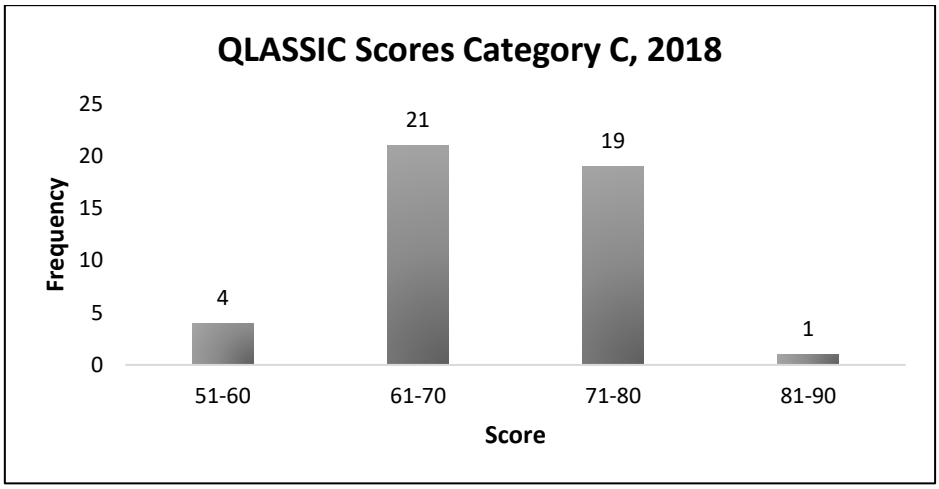


Figure 4.108: QLASSIC Scores for Category C in 2018.

Category D

QLASSIC scores for Category D in 2018 are shown in Figure 4.109. Here, the majority of projects (9) received a score between 71 and 80, followed by five projects scoring between 81 and 90. The minority of projects scored between 61 and 70 (3 projects) with one project scoring between 51 and 60.

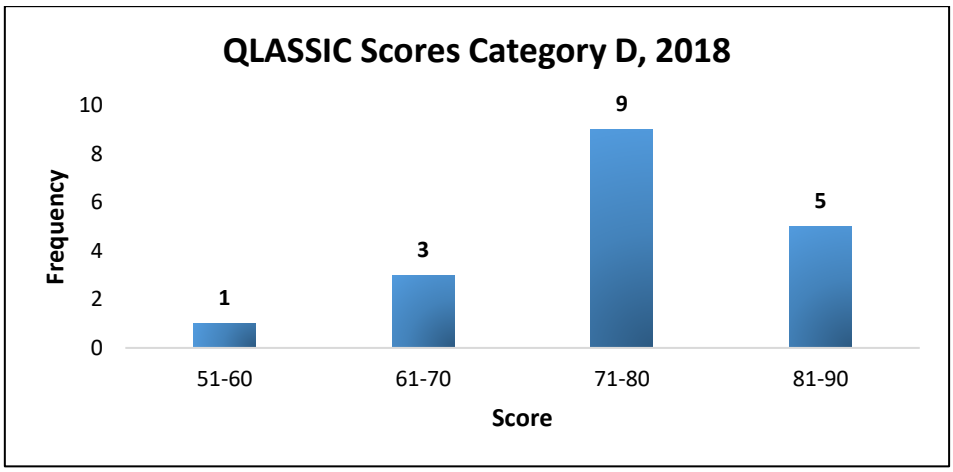


Figure 4.109: QLASSIC Scores for Category D in 2018.

Summary

Table 4.3 displays the mean scores for all categories between 2015 and 2018). For 2015, the total mean score for all categories is 73, with the highest score (81) represented by Category D followed by Category A with a mean score of 74. For 2016, the total mean score is 72 score with the highest score represented by Categories A and B of 72.

The scores for 2017 are similarly showing a total mean score of 72, where Category D recorded the highest score of 77 followed by Category B with a score of 74. For 2018, Categories A and D had the highest mean score of 75, followed by Category B with a score of 74. The total mean score for 2018 was 74.

The number of projects and scoring for all categories between 2015 and 2018 is illustrated in Figure 4.110.

Table 4.3: Mean Score for all Categories between 2015 and 2018.

Year	Category	Mean Score	Total Mean Score
2015	A	74	73
	B	70	
	C	73	
	D	81	
2016	A	72	72
	B	72	
	C	71	
	D	65	
2017	A	72	72
	B	74	
	C	72	
	D	77	
2018	A	75	74
	B	74	
	C	69	
	D	75	

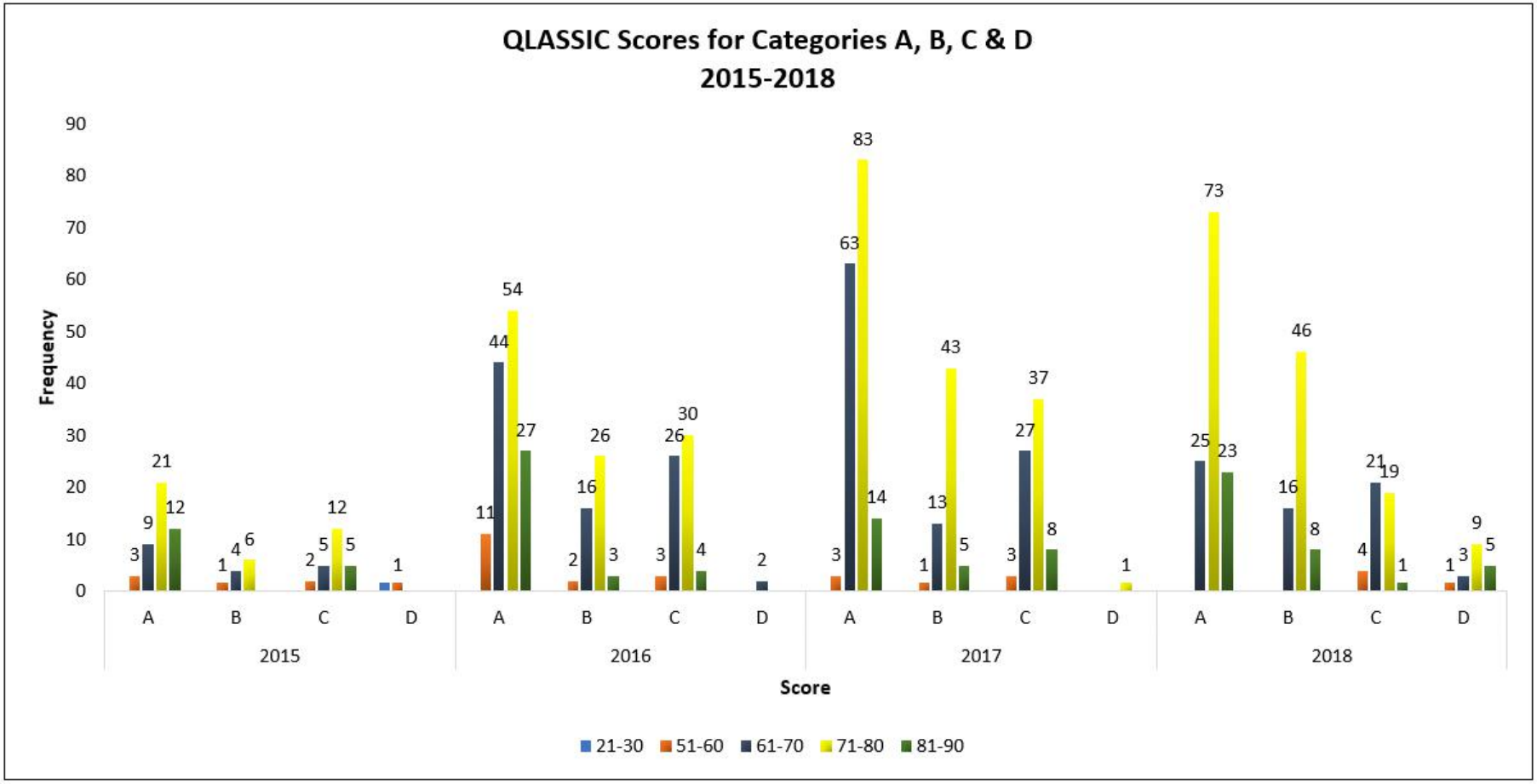


Figure 4.110: QLASSIC Scores for all Categories between 2015 and 2018

4.3. The Number of Assessments by State and Category between 2015 and 2018

Figure 4.111 and Table 4.4 below display the trend of QLASSIC assessments by state and category between the period 2015 and 2018. The majority of projects were from Selangor and Johor. The least number of assessments resulted from Kelantan having only one project. Most assessments are represented by Category A followed by Category B. The year 2017 recorded the highest number of assessments represented by Category A followed by 2016, as the second highest.

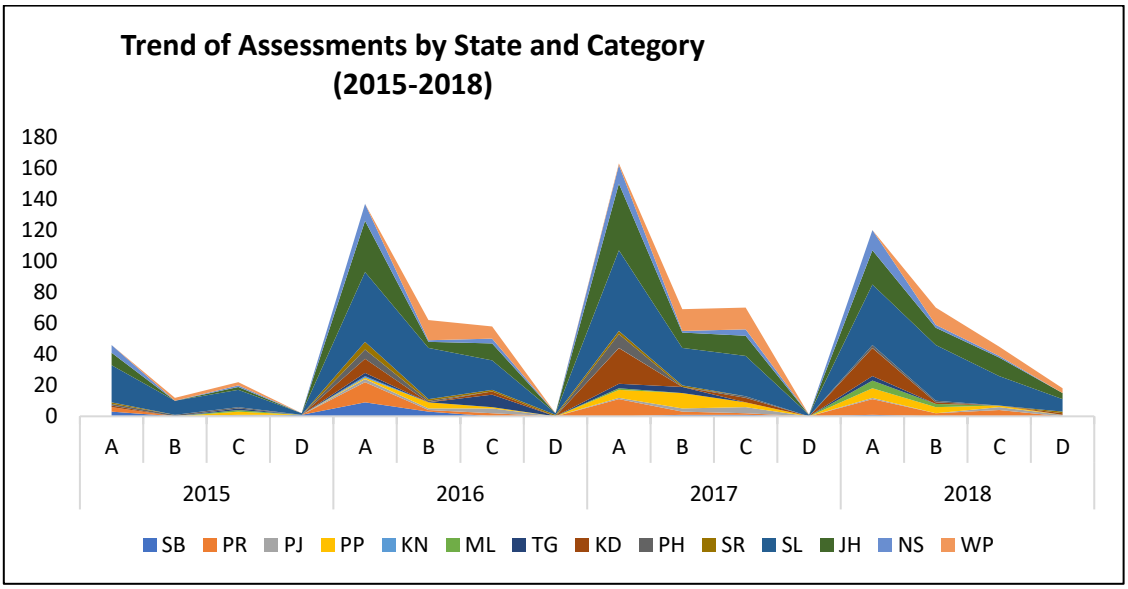


Figure 4.111: Trend of Assessments by State and Category (2015-2018).

Table 4.4: Number of Assessments by State and Category (2015-2018).

YEAR	2015				2016				2017				2018				TOTAL
CATEGORY /STATE	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	
Sabah (SB)	3			1	9	3				1	1		1				**19**
Perak (PR)	3				13	1	2		11	2	1		10	2	4		**49**
Putrajaya (PJ)			1		2	1	3		1	2	4		1		2	1	**18**
Pulau Pinang (PP)			2		1	4	1		5	10	3		6	4	1		**37**
Kelantan (KN)					1												**1**
Melaka (ML)			1						1				5	2			**9**
Terengganu (TG)			1		2		8		3	4			3				**21**
Kedah (KD)	1				9		2		23		3		18	1		1	**58**

YEAR	2015				2016				2017				2018				TOTAL
CATEGORY /STATE	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	
Pahang (PH)	1	1	1		6	1			9		1		2	1			**23**
Sarawak (SR)	1				5	1	1	1	2	1						1	**13**
Selangor (SL)	24	9	11	1	45	33	19	1	52	24	26	1	39	36	19	8	**348**
Johor (JH)	8		2		33	4	11		43	10	13		22	11	12	4	**173**
Negeri Sembilan (NS)	5		1		11	1	3		12	1	4		13	2	1		**54**
Kuala Lumpur (WP)		2	2			13	8		1	14	14			11	6	3	**74**
TOTAL	**46**	**12**	**22**	**2**	**137**	**62**	**58**	**2**	**163**	**69**	**70**	**1**	**120**	**70**	**45**	**18**	

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion and Recommendation on the Defect Group

The defect group elements in this study were divided into 22 elements along with its defect group. The elements were divided into three sections, namely Architectural works, External works, and Basic M&E Fittings. The Architectural works comprised of 10 elements, External works 1 had four elements, External works 2 had four elements, and External works 3 consisted of three elements. The Basic M&E fittings consisted of five defect groups.

The findings of this study showed 'Finishing' as the main defect group for most of the elements, which consisted of Floor, Internal Wall, Ceiling, External Wall, and Roof. The defect groups for Material & Damages included the elements of Door, Window, and Internal Fixtures and the defect group, Drain consisted of Apron & Perimeter Drain and External Drain elements. The defect group for External Wall included Electrical Substation and Bin Centre, and the element of Basic M&E fittings had a defect group represented by Joints & Gaps for all years. The defect group, Floor was represented by the elements, namely Playground, Court, Link-way/Shelter, and Car park/Car porch.

Based on the results of this study, it can be concluded that the main recommendation is to address the issue associated with defect group, Finishing and Floor. Moreover, the material used to construct floors should be first checked beside the matters associated with the handling of materials. The other defect group that should be considered include Material & Damages, Drain, External Wall and Joints & Gaps.

5.2. Conclusion and Recommendation on QLASSIC Scoring Benchmarks

The CITP propose that the improvement of quality standards should be addressed by increasing QLASSIC assessments within the construction industry. Importantly, the system assesses the workmanship of contractors and broader quality assurance matters in the construction of buildings, thus leading to improvements in the quality of both the contractors and overall construction work. The CITP KPI for the QLASSIC assessment score for Q4 2020 was 70.

From the total sum of projects (887) that had undergone QLASSIC assessments for the period between 2015 and 2018), the total mean QLASSIC score was 73, 72, 72 and 74, respectively. Table 3 displays the overall mean score, 72.75.

In conclusion, the overall mean QLASSIC score exceeded the CITP KPI, which was 70.

Table 5.1: Overall Mean Score for all Categories (2015-2018).

Year	Category	Mean Score	Total Mean Score	Overall Mean Score
2015	A	74	73	72.75
	B	70		
	C	73		
	D	81		
2016	A	72	72	
	B	72		
	C	71		
	D	65		
2017	A	72	72	
	B	74		
	C	72		
	D	77		
2018	A	75	74	
	B	74		
	C	69		
	D	75		

Accordingly, the main recommendation of this study is that CIDB should enforce developers to include the minimum QLASSIC score as part of their contractual requirements for residential projects. This enforcement will help to enhance the quality of workmanship on building and construction projects in Malaysia.

APPENDIX

Appendix 1: QLASSIC Excellence Awards 2019

PROJECT	PROJECT OWNER (S)	MAIN CONTRACTOR	PROJECT ARCHITECT
HIGHEST QLASSIC ACHIEVEMENT AWARD 2019			
SAUJANA DUTA PHASE 2L SEREMBAN, NEGERI SEMBILAN	SEREMBAN TWO HOLDING SDN. BHD.	TIMBUNAN BAKTI CONSTRUCTION SDN. BHD.	DESIGN COLLECTIVE ARCHITECTURE NETWORK SDN. BHD.
HIGH QLASSIC ACHIEVEMENT AWARD 2019 LANDED RESIDENTIAL DEVELOPMENT			
ELMINA VALLEY 1 PHASE EV1A, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD.	AIMA CONSTRUCTION SDN. BHD.	SENIWISMA ARCHITECT ENGINEER SDN. BHD.
ELMINA VALLEY 1 PHASE EV1B, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD.	SRI MANSANG SDN. BHD.	SENIWISMA ARCHITECT ENGINEER SDN. BHD.
ELMINA VALLEY 2 PHASE EV2A, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD.	PA BUILDERS SDN. BHD.	HIA ARCHITECTS SDN. BHD.
ELMINA VALLEY 2 PHASE EV2B, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD.	PA BUILDERS SDN. BHD.	HIA ARCHITECTS SDN. BHD.
ELMINA VALLEY 3 PHASE EV3A, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD.	NISSIN BUILDERS SDN. BHD.	PARADIGM ARCHITECTS SDN. BHD.
ELMINA VALLEY 3 PHASE EV3B, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD.	KITACON SDN. BHD.	PARADIGM ARCHITECTS SDN. BHD.
ELMINA VALLEY 4 PHASE EV4A, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD	AIMA CONSTRUCTION SDN. BHD	VISAGE ARCHITECT
ELMINA VALLEY 4 PHASE EV4B, ELMINA WEST SHAH ALAM, SELANGOR	SIME DARBY PROPERTY BERHAD	JALLCON (M) SDN BHD	VISAGE ARCHITECT
ESTUARI GARDENS PUTERI HABOUR – JOHOR BAHRU, JOHOR	BANDAR NUSAJAYA DEVELOPMENT SDN. BHD.	INTA BINA SDN. BHD.	PARADIGM ARCHITECTS SDN. BHD.
N'DIRA TOWNHOUSE PUCHONG SOUTH SELANGOR	LUSH DEVELOPMENT SDN. BHD.	AIMA CONSTRUCTION SDN. BHD.	ATELIER ADT ARKITEK (ASIA) SDN. BHD.

PROJECT	PROJECT OWNER (S)	MAIN CONTRACTOR	PROJECT ARCHITECT
REDUP & SANTAI PHASE 4A&4b BANDAR AINSDALE, SEREMBAN NEGERI SEMBILAN	SIME DARBY PROPERTY BERHAD.	MAKASSAR SDN. BHD.	PARADIGM ARCHITECTS SDN. BHD.
SAUJANA DUTA PHASE 2L SEREMBAN NEGERI SEMBILAN	SEREMBAN TWO HOLDINGS SDN. BHD.	TIMBUNAN BAKTI CONSTRUCTION SDN. BHD.	DESIGN COLLECTIVE ARCHITECTURE NETWORK SDN. BHD.
SEJATI RESIDENCES PHASE 2A, CYBERJAYA SELANGOR	PARAMOUNT PROPERTY (CJAYA) SDN.	INTA BINA SDN. BHD.	SA ARCHITECTS SDN. BHD.
TIANA, PHASE G6 ELMINA EAST, SHAH ALAM SELANGOR	SIME DARBY PROPERTY BERHAD.	AIMA CONSTRUCTION SDN. BHD.	ALMAZ ARCHITECT SDN. BHD.
HIGH QLASSIC ACHIEVEMENT AWARD 2019 HIGH RISE RESIDENTIAL DEVELOPMENT			
ANGGUN RESIDENCES WILAYAH PERSEKUTUAN KUALA LUMPUR	UDA HOLDING BERHAD	CREST BUILDER SDN. BHD.	RSP ARCHITECTS SDN. BHD.
KIARA COURT, PHASE NU5C NILAI IMPIAN NEGERI SEMBILAN	SIME DARBY PROPERTY BERHAD	AIMA CONSTRUCTION SDN. BHD.	AZMAN ARCHITECTURAL CONSULTANCY
PAVILION BANDAR PUTERI PUCHONG, PUCHONG SELANGOR	IOI PROPERTIES GROUP BERHAD	SRI BINARAYA SDN. BHD.	ADJ ARCHITECTURE SDN. BHD
PUTRA RESIDENCE PHASE 5Q, PUTRA HEIGHTS PETALING JAYA, SELANGOR	SIME DARBY PROPERTY BERHAD	T.J. CIVIL & STRUCTURAL CONTRACTOR SDN. BHD.	S&A ARCHITECTS SDN. BHD.
THE LOFT @ SOUTHBAY CITY BATU MAUNG, PULAU PINANG	VIENNA VIEW DEVELOPMENT SDN. BHD	BUILTECH PROJECT MANAGEMENT SDN. BHD.	ARKITEK H SUN
HIGH QLASSIC ACHIEVEMENT AWARD 2019 NON-RESIDENTIAL DEVELOPMENT			
PONDEROSA AVENUE JOHOR BAHRU, JOHOR	RAWHIDE SDN. BHD	TSK CONSTRUCTION SDN. BHD.	SH MOK ARCHITECT
QLASSIC SPECIAL APPRECIATION GOVERNMENT PROJECTS 2019			
10 RESIDENSI SHAH ALAM, SELANGOR	PERBADANAN KEMAJUAN NEGERI SELANGOR (PKNS)	IBRAHIM MIAN SDN. BHD.	BAHAGIAN ARKITEK PKNS
HIJAUAN ENKLAF SHAH ALAM, SELANGOR	PERBADANAN KEMAJUAN NEGERI SELANGOR (PKNS)	IBRAHIM MIAN SDN. BHD.	BDA ARCHITECTS SDN. BHD.
	KEMENTERIAN DALAM NEGERI (KDN)		SN SHAMSUL RIZAL ARCHITECT

PROJECT	PROJECT OWNER (S)	MAIN CONTRACTOR	PROJECT ARCHITECT
IBU PEJABAT JABATAN PENJARA MALAYSIA KAJANG, SELANGOR	JABATAN PENJARA MALAYSIA JABATAN KERJA RAYA MALAYSIA (JKR)	PEMBINAAN SUJAMAN SDN. BHD.	
PERUMAHAN PENJAWAT AWAM MALAYSIA (PPAM) METROPOLITAN KEPONG (MRR2) KUALA LUMPUR	JL99 HOLDINGS SDN. BHD. PERUMAHAN PENJAWAT AWAM MALAYSIA (PPAM)	BINASTRA CONSTRUCTION (M) SDN. BHD.	PING NG ARCHITECT
SKYAWANI RESIDENCE SENTUL, KUALA LUMPUR	SKYWORLD DEVELOPMENT SDN. BHD. KEMENTERIAN WILAYAN PERSEKUTUTAN	PEMBINAAN TUJU SETIA SDN. BHD.	ARKITEK S.H.LIM
RUMAH MAMPU MILIK JOHOR (RMMJ) TAMAN PULAI HIJAUAN PULAI, JOHOR	GRANDEUR PARK SDN. BHD. SETIAUSAHA KERJAAN NEGERI JOHOR (SUKJ)	ATLANTIS C&E SDN. BHD.	RDC ARKITEK SDN. BHD.

CIDB MALAYSIA