Design and Assessment of An Electrical Load Schedule Template Using Microsoft Excel

CEEJAY S. BALINGIT[1], JOHN PAULO L. CARREON[2], RHEY MARK O. CASTRO[3], JAN CHRISTIAN D. GUANLAO[4], MURIEL ANDREAH C. OCAMPO[5], FRENEIL R. PAMPO[6], LOUIE G. SERRANO[7]

[1, 2, 3, 4, 5, 6, 7] *Department of Electrical Engineering, College of Engineering and Architecture, Don Honorio Venture State University, Cabambangan, Villa de Bacolor, Pampangan, Philippines*

Abstract— This study aimed to develop an electrical load schedule template using Microsoft excel which produces faster and more precise results in generating Electrical load schedules. The research has come up with a template for establishment application using standards of the Philippine Electrical Code. In addition, this study will consider manual computations and compare them with the template calculation output that would address the effectiveness of the template. The medium that is used in creating the template is the software so called Microsoft excel. This software was chosen due to the fact that it is widely used and is best in storing data and can form calculations. To develop this template the researchers made an in-depth review with regards to the standards of the Philippine Electrical Code to gather all the necessary data. Then after all the data were gathered the template was programmed. The developed template is assessed by licensed electrical practitioners to know its effectiveness of the template. The data in the assessment showed that the developed template is recommendable to other electrical practitioners since the template can use practically and it can lessen the working time of the user. In addition, the researchers also concluded that this tool allows you to calculate the electrical load schedule, and display parallel computation results. Add-Ins (software extensions) give you more power and open up new possibilities

Indexed Terms— Philippine Electrical Code, Template, Electrical load schedule, Microsoft Excel

I. INTRODUCTION

Designing an electrical load schedule is a crucial part in the work of a licensed electrical practitioner. Doing this task requires a great deal of attention to detail and caution, as missing a single specification in the load schedule may lead to an electrical fault or hazard. In the past decades people managed computations or budgets using paper, pencil, and calculators, however that method is time consuming and tedious with its limitations such as how sheets were modified manually in adding or removing columns and rows. Given that designing an electrical load schedule in those decades utilized a similar format, the amount of time and work needed to accomplish that can be exhausting.

Nowadays, Microsoft Excel is one of the most widely used software programs in the world, with millions of users relying on it to create, comprehend, model, predict, and collaborate (Microsoft, 2021). The development of the program allowed those previously stated limitations to be overcome, making the overall job easier. Microsoft Excel is a versatile spreadsheet tool that lets you organize data, perform calculations, make choices, graph data, and create professional-looking reports (Adebesi, 2013). Licensed electrical practitioners benefited greatly from the said software, particularly the software's use in computing the electrical load schedule of a certain establishment. Moreover, electrical practitioners can freely create their own templates for designing electrical load schedules.

Electrical load scheduling is the practice of estimating the instantaneous loads that are running in an installation. The schedule calculates the load for a specific installation in terms of apparent, reactive, and active power (kVA, kVAR, and kW respectively) and is often performed at the sub facility or switchboard. Load schedule preparation should ideally be the first task completed during the electrical system design stage, given that it is related to equipment sizes and

other power system requirements. In particular, it provides information about the equipment ratings during normal and peak operations, assisting the electrician in determining conductor sizes (Electrical Equipment, 2017). The reality of constructing and operating urban power supply networks, according to Suslov et al. (2019), has revealed that real loads are typically lower than projected, resulting in an overpricing of technological connection costs.

The process of planning a system in terms of equipment sizing and power system studies is made easier by preparing an electrical load schedule. The data in load schedules are usually supported by calculations based on standard electrical codes. Creating an electrical load schedule is a critical task that an electrical technician should perform during the early stages of an electrical power installation. The load schedule provides data that is a close approximation of the amount of power consumed for normal, peak, and anything in between loads (Electrical Equipment, 2017). Making a load schedule for a certain establishment can take a lot of time and meticulosity, because a mistake in choosing the protective device will cause electrical hazards. Electrical load scheduling also needs to be based on the electrical codes where the standards are written, and the sheer number of codes make it difficult to remember all of them.

This research aimed to develop a template that can compute the electrical load schedule that complies with the standards of the Philippine Electrical Code instantly. The template was programmed using Microsoft Excel since the software is widely known and user-friendly. The template was be assessed by licensed electrical practitioners before being launched to the public.

Review of Related Literature

The Philippine Electrical Code is used nationally for the practical safeguarding of persons and property from hazards and dangers arising from the use of electricity. This code contains provisions that are considered minimum requirements necessary for safety. Compliance therewith and proper maintenance will result in an installation that is essentially free from hazards but not necessarily efficient, convenient, or adequate for good service or future expansion of

electrical use (Institute of Integrated Electrical Engineers of the Philippines, 2017).

The National Electrical Code (NEC), or NFPA 70, is a regionally adopted standard for the safe installation of electrical wiring (National Electrical Code 2014). The NEC codifies the requirements for secure electrical installations into a single, standardized source. While not a law, NEC is commonly ordered by local law for safety measures. It can be and often is adopted by cities, and municipalities in an effort to standardize their enforcement of safe electrical practices.

Power-flow problems in electrical power networks have been investigated over the years and several calculation methods were introduced. In order to determine the work state of a power network, it is often necessary to solve a large system of nonlinear transcendental equations. Microsoft Excel, as a part of the Microsoft Office software package, is widely known in the world and easily accessible. Excel possesses a plug-in called "Solver" which is a tool used for constrained optimization and solving of nonlinear equations (Zeljkovic et al., 2006).

Microsoft Excel is one of the most popular spreadsheet programs considering its quality and moderately simple utilization. It is appropriate for both logical and instructive purposes, particularly scientific and factual. Through the use of this program, it is possible to solve electrical problems and analyze similar situations.

The most recent edition of Microsoft Excel was able to offer solutions to the most common difficulties users encounter. Microsoft made specific decisions in the design of the spreadsheet optimizer that comes with Microsoft Excel. Load management entails carefully scheduling device operation hours to minimize electricity costs (Fei Hu et al., 2014). Researchers applied a novel approach to electric load management to find the best device scheduling without impacting production.

Statement of the Problem

Small-time licensed electrical practitioners modify their template whenever they design a load schedule due to the fact that every establishment has different

loads. Modifying a template is a lengthy process and requires focus so as not to risk any inaccuracy of the load schedule. To address this issue, this research primarily aimed to utilize and enhance an electrical load schedule template using Microsoft Excel. This template could potentially lessen the hassle in designing electrical load schedules regardless of what electrical system is used, avoiding any possible confusion or mishap when designing an electrical load schedule.

Specifically, the researchers sought to answer following the questions:

1.   Is the template effective in achieving the result with the least amount of time and effort invested, and reliable as a basis for computing the electrical load schedule?

2.   How the template will be assessed by the expert in terms of: a. Data; b. Structure; and c. Application?

GENERAL OBJECTIVE

This study intended to design an electrical load schedule template based on the standards of the Philippine Electrical Code using Microsoft Excel that can help licensed electrical practitioners in the Philippines in computing the electrical loads of an establishment with less time consumption.

●   To design a hassle-free template for computing the electrical load schedule.

●   To enhance an electrical load schedule template based on PEC using Microsoft Excel to be assessed by the licensed electrical practitioners.

This study specifically deals with the development and assessment of an Electrical load Schedule template using Microsoft Excel in the field of Electrical Design. The template will only cover 230 Volts single phase and three phase, along with commercial (small retail buildings), institutional (small government buildings, school buildings), industrial (small manufacturing), and residential unit's electrical load schedule. The template was assessed by licensed electrical practitioners. A digital questionnaire is used for the assessment of the template. The template is only applicable to electrical practicing students and licensed electrical practitioners.

Conceptual Framework
Figure 1: Conceptual Framework
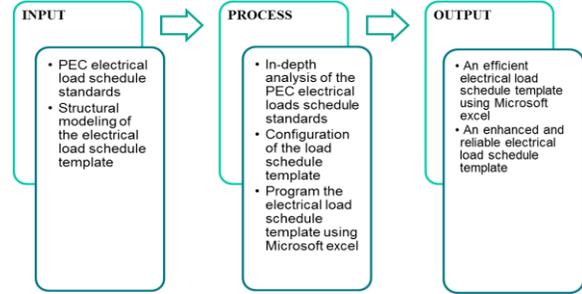
As shown in Figure 1, the researchers reviewed the Philippine Electrical Code, especially the standards in designing the electrical load schedule of a certain establishment and conceptualized the template which includes the format and presentation.

Upon reviewing the PEC and conceptualizing the template, the researchers conducted an in-depth analysis with regarding the standards of the Philippine Electrical Code. Then the template of the electrical load schedule was configured based on the analysis. The following step was to program the structural and mathematical modeling of the system of the electrical load schedule using Microsoft Excel Visual Basic for Applications. Once done with the programming, the electrical load schedule was used by a licensed electrical practitioner for the assessment of templates. Lastly, the assessment was used as feedback to determine the areas that needed to be improved, the benefits of the template, and if the template met the expectations of the users. The outcome of this study is to have an efficient electrical load schedule template that is based on the standards of the Philippine Electrical Code. In addition, the output is also an enhanced and reliable template that can be used by licensed electrical practitioners.

II. METHODOLOGY

The researchers used the Design and Development design model for the study (Richey & Klein, 2014). The study had undergone through three (3) primary phases in order to execute this model: design, development, and assessment. In the design phase, the researchers gathered information by examining the requirements of the Electrical Load Schedule template while also adhering to the Philippine Electrical Code's

standards. The requirements of the Electrical load schedule template and the PEC standards were used as guidelines in the designing of the template and layouts. In the development phase, the researchers used the gathered and analyzed information in creating the template by programming Microsoft Excel using Visual Basic for Applications. Lastly, the assessment phase judged the quality of the template to gauge the efficiency and reliability of the new template. This design allowed for a thorough research on electrical load schedules in developing a template using Microsoft Excel. Revisions on the template were done based on the assessment results.

For this study, ten (10) licensed electrical practitioners who have knowledge and experience in electrical load design were selected as respondents through random sampling. Sampling is a researcher's method of selecting the group of participants (The sample is the number of people who will take part in the study). According to Thomas (2020), a simple random sample is a subset of a population chosen at random. Because it only takes a single random selection and little prior knowledge about the population, this method is the simplest of all the probability sampling methods. Any research conducted on this sample should have excellent internal and external validity due to the randomization.

The researchers used two methods in collecting the data needed for this developmental research. Data plays a vital role in completing research studies due to the fact that it supports the issues around the research gap. This study used two types of sources of data which are primary and secondary sources. The data source that the researchers referenced included the Philippine Electrical Code (2017) and licensed electrical practitioners. The researchers reviewed the latest edition of the Philippine Electrical Code which contains required information in designing an electrical load schedule. People with a license in designing an electrical load schedule were asked to assess the template that was developed by the researchers in terms of reliability and efficiency of the electrical load schedule template.

The instruments used in the data collection process were template assessment sheets, and also the Philippine Electrical Code (2017) standards. The book

used to review the information from the data source was the Philippine Electrical Code 2017. After the development of an electrical load schedule template, an assessment sheet for judging the template's data, efficiency, and application was crafted by the researcher using the Likert Scale to produce a numerical output in the assessment.

I. Likert Scale

The Likert Scale is a psychometric response scale that is commonly used in assessments to determine a participant's preferences or level of agreement with a statement or collection of assertions. Likert scales are a non-comparative, one-dimensional (only measuring a single characteristic) scaling technique. Respondents

Scale	Range	Interpretation
1	1.49 and Below	Strongly Disagree
2	1.50 to 2.49	Disagree
3	2.50 to 3.49	Undecided
4	3.50 to 4.49	Agree
5	4.50 and Above	Strongly Agree

are asked to indicate their level of agreement with a given statement by way of an ordinal scale (Bertram). Upon acquiring the information needed from the assessment of the template, the data was encoded in order to compute and determine the respondents' ratings. The data was then organized as a reference for the development of the template. The mean was solved by:

II. Mean
Formula:

$$\overline{X} = \frac{\sum X}{N}$$

Where:

$\overline{X}$ = Mean

$\sum X$
= Summation of All Data Values
N = Total Number of Population

Electrical Load Schedule Template Based on Philippine Electrical Code (PEC)

The selected materials were based on the standards Philippine Electrical Code 2017. The following tables are the standards of the Philippine Electrical Code in selecting the appropriate materials; the ampere trip rating of the breaker (see PEC 2017 Table 2.40.1.6(A)), ampere frame rating, table of service wire ampacity (see PEC 2017 Table 3.10.2.6(B)), table of ground wire size (see PEC 2017 Table 2.50.3.17 and Table 2.50.6.13), size and type of conduit (see PEC 2017 Table 10.1.1.1, Table 10.1.1.4, and Table 10.1.1.5), a single phase alternating current motor (see PEC 2017 Table 4.30.14.2), three phase alternating current motor induction & synchronous (see PEC 2017 Table 4.30.14.4), and the table of alternating current reactance and resistance for wire in conduit (see PEC 2017 Table 10.1.1.9).

The formula for load computations
- Lighting and Convenience outlet loads
- Lights (VA) = quantity x watts
- Outlet (VA) = quantity x 180 watts
- Appliances load computations
- For the equipment, the user will input the wattage rating of the equipment
- Motor load

Single phase Motor = (full load in current single phase AC motors PEC table 4.30.14.2)

Three phase Motor = (full load in current three phase AC motors PEC table 4.30.14.4)

To get the full load current of the lighting, outlet, and equipment load the formula used is FLC = VA/230

Conductor Sizing
To get the conductor size of each load the formula used is wire size = FLC x 1.25 (PEC 2.10.2.2)

Overcurrent Protection Rating
- Lighting, Convenience, and Appliances load

The overcurrent protection rating should be able to carry the calculated line current. It should be the highest overcurrent protection/circuit breaker that is commercially available. The overcurrent protection's ampere trip should not be greater than the ampacity of the conductor being protected.

- Motor load
The overcurrent device protecting on individual motor branch circuit must be able to carry the motor starting current. It must have a time delay to allow the motor to start and come up to speed.

To get the breaker size of motor load the full load current of the motor is multiplied by the maximum rating of the motor branch circuit (PEC table 4.30.4.2) Main Service wire and OCPD sizing
- Single phase
Size of wire
IF = (IFL x D.F) + 25% (HML)
Size of breaker
IMCB = (IFL x D.F) + 150% (HML)

- Three phase Size of wire (WYE)
IL = [(Largest Phase Current x 3) + (0.25 x LML) + 3phase load] [Demand Factor] Size of wire (DELTA)
IL = [(Largest Phase Current x 1.732) + (0.25 x LML) + 3phase load] [Demand Factor]
Size of the breaker (WYE)
IMCB = [(Largest Phase Current x 3) + (1.5 x LML) + 3phase load] [Demand Factor] Size of the breaker (DELTA)
IMCB = [(Largest Phase Current x 1.732) + (1.5 x LML) + 3phase load] [Demand Factor]

Voltage Drop Calculation
To compute the voltage drop across a conductor, a simple formula was utilized using

Ohm's law for a single phase. The formula used was $VD = 2I\dot{}Z\left(\frac{L}{305}\right)\left(\frac{1}{N}\right)$, and for three phases $VD = I\sqrt{3}\,Z\left(\frac{L}{305}\right)\left(\frac{1}{N}\right)$ to get the impedance. Philippine Electrical Code (PEC) table 10.1.1.9 was used to determine the resistance and reactance of the wire. This method can be used to calculate the voltage drop across a circuit as well as the wire gauge size required for your circuit depending on the maximum desired voltage drop. The voltage drop of a feeder circuit must

not exceed 5%, and the voltage drop of a branch circuit must not exceed 3%, according to the Philippine Electrical Code.

Program Development

All the gathered data, the structure of the electrical load schedule, and the formula were coded in Excel. The Visual Basic for Applications was used to program Excel, as it allows users with limited knowledge in programming to quickly develop useful Microsoft Windows applications that can link and embed objects, such as Excel spreadsheets. Other programming languages are considered like Java, requires more time and knowledge in cross-platform development and were therefore excluded in the study.

Figure 2: Program development flow
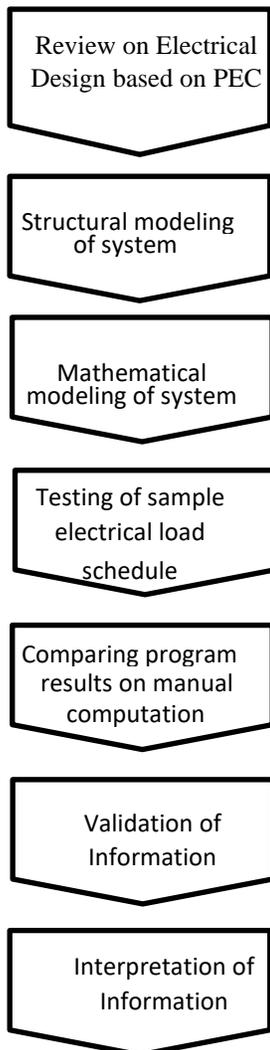
Program development flow
1. Review on Electrical Design based on Philippine Electrical Codes – The researchers need the knowledge of construction and computation of electrical load schedule tables.
2. Structural modeling of the system – This process involves the creation of possible cases and combinations of the required inputs.
3. Mathematical modeling of systems – This process involves the formulations of equations that will be used for the desired results that require different types of equations and concepts.
4. Testing of sample electrical design – Testing of samples of different types of establishments, or different types of branch circuits in panel box (how many) and different loads were to be considered in order to test the accuracy of results.
5. Comparing program results on manual computation – The program results will be compared to the manual computation results to see if there are discrepancies with the values.
6. Validation of information – If the program gives results equal to the manual computation, the results are considered to be valid. All the results must be proved to be valid for the template to be called accurate.
7. Interpretation of information – It involves the analysis of information that the template gives, and whether it yielded faster and more accurate results.

Figure 2.1: Template on excel flow

```
┌──────────────────┐
│  Start the excel │
│     template     │
└──────────────────┘
         │
┌──────────────────┐
│ Single phase/Three│
│      phase       │
└──────────────────┘
         │
┌──────────────────┐
│    Input data    │
└──────────────────┘
         │
┌──────────────────┐
│Construction of Load│
│     Schedule     │
└──────────────────┘
         │
┌──────────────────┐
│   Computation    │
└──────────────────┘
         │
┌──────────────────┐
│  Display Results │
└──────────────────┘
         │
┌──────────────────┐
│       Save       │
└──────────────────┘
```
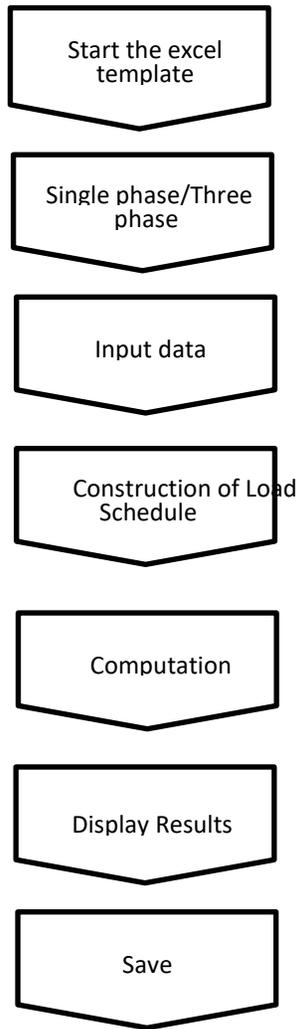
Template on excel flow
1. Start
2. Single phase/Three phase – The user will choose what system will be used, whether a single phase or three phase system.
3. Input Data – The user will input all the required information in creating the electrical load schedule.
4. Electrical load schedule table – The information that was input by the user will be shown in the Excel sheet including circuit number, rated voltage, rated current, size of wires and conduit, description of loads, number of poles, Ampere trip and frame, KAIC, size of breaker.
5. Computation – The program will perform the computation. it will compute the rated current,

total VA, size breakers, and gives the size of wires conduits and breakers rating.
6. Display Results – The excel should then display the computed results in the electrical load schedule table and it will display the size of wire and conduit, the circuit breaker rating of each load, and also the size of feeder wire and main circuit breaker rating.
7. Save

III. RESULT AND DISCUSSION

In this section of the research, several findings were enumerated based on the data collected. The data includes the Philippine Electrical Code (2017), findings on the design and development process, and the produced template assessed by the licensed electrical practitioner using the template evaluation sheet.

Graphical User interface

Figure 3: Initial Interface of the template after opening the Excel

The program for scheduling electrical loads using Microsoft Excel as shown in Figure 3. Upon opening Microsoft Excel the user will be directed to the click button "create panel board".
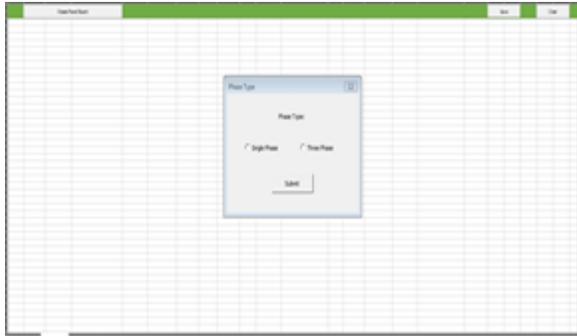
Figure 3.1: Power system

Figure 3.1 shows that after clicking the "create panel board", the option to select for the power system (single phase/ three phase) to be used will appear.
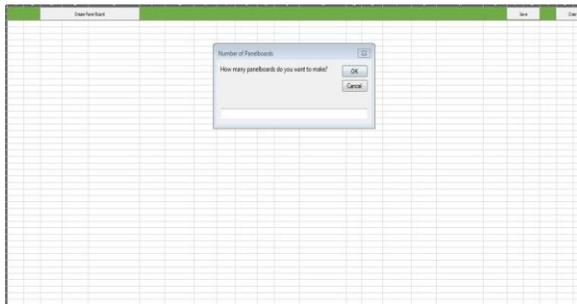
Template calculation

Figure 3.1.1: Panel board draft

As shown in Figure 3.1.1, the template will ask how many panel-boards the system will create and also ask to automatically create the main panel board. The table is programmed to layout automatically while the user is working on the Electrical load schedule.
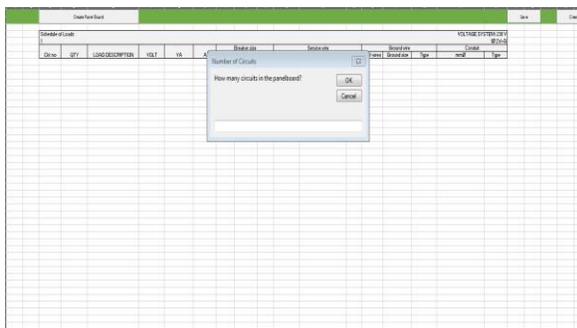

Figure 3.1.2: Number of Circuits

As presented in Figure 3.1.2 the program will request to input the number of circuits needed.
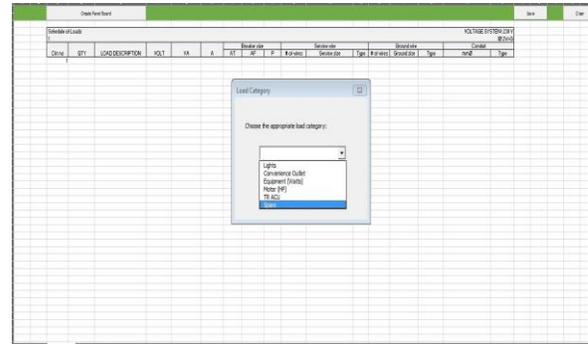
Figure 3.1.3: Load Category

Figure 3.1.3 shows the load category in which the user had 5 options, the lights, convenience outlet, equipment, motor, TR ACU and spare. For the lighting load, the program will request the quantity, load description, wattage, and conduit type. The quantity has no limit it depends on the desired quantity of the user. In the load description, there are options that the user can choose from. The wattage is limited to a maximum of 100 watts. In conduit type options are also presented where the user can select. The program will ask for the number of convenience outlets based on the user's desired number of outlets, as well as load descriptions and conduit type, which both have parameters. Regarding the load of the appliance, the program will ask for the wattage rating of the equipment and also the load descriptions, and the conduit type. For the motor, the program will ask the load description of the motor, its horsepower rating, and also the conduit type to be used. The template will inquire about the TR ACU's size as well as the conduit type to be used.
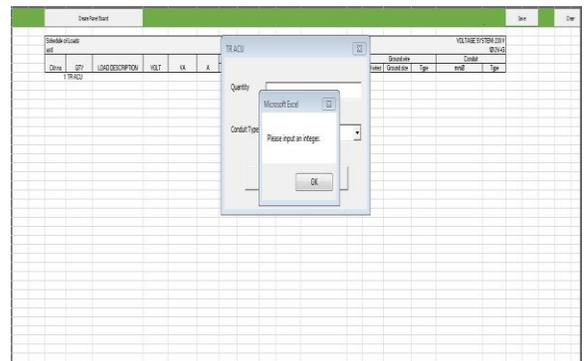

Figure 3.1.4: Integers

If the user forgets to input the integers and the inputs are wrong, the template will not proceed until the user

correct it and a form will show that the user has made a mistake.
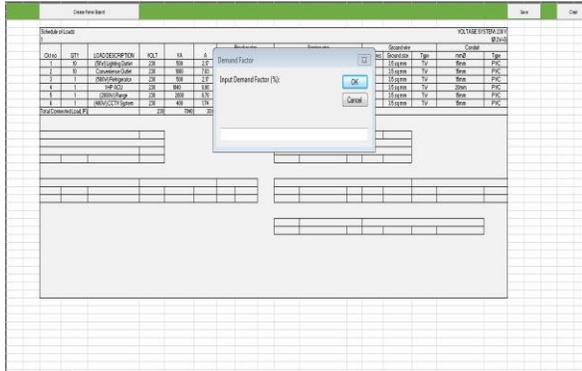

Figure 3.1.5: Demand factor

After setting all the load in the circuits, it is seen in Figure 3.1.5 that the program will ask for the demand factor to solve for the ampacity of the feeder wire and overcurrent protection device rating. After that, the system will automatically set out the standard main service wire and breaker rating size. The main breaker type will also be asked, and the user may select from all the possible options for the circuit breaker.

Comparison between the template and manual calculation
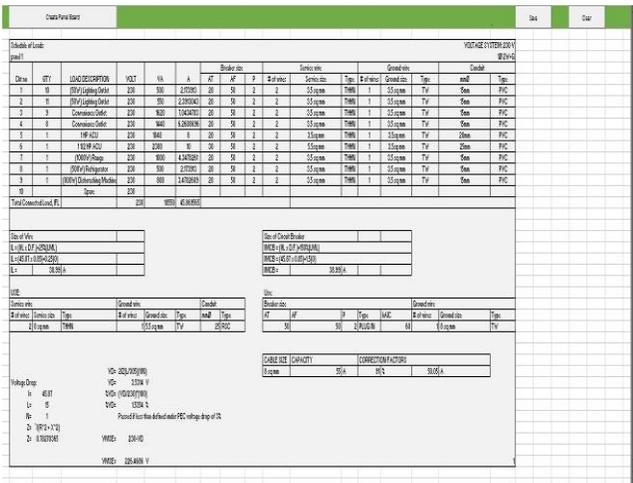
Figure 4: Single phase Template Calculation
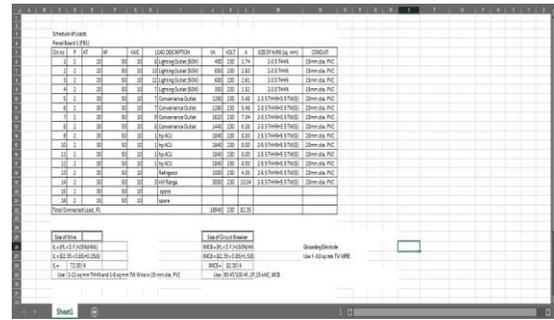
Figure 4.1: Single phase Manual Computation

The two figures above demonstrate the comparison of the single-phase template and manual computation. The layout of the two is almost the same but it differs in how the electrical load schedule is made. In the manual computation, the formulas for the required computations were coded per unit cell, and the tables of standard materials in the PEC book were consulted in the process. In contrast, the developed template contains all relevant data from the PEC book that are needed in doing electrical load schedules built in, no longer requiring the user to manually check the tables of standard materials. In addition, the template also guides the user in doing electrical load schedules, the save button and clear button are also in the developed template. For the save button when the user clicked it the template will automatically save in the computer while the clear button will erase all the generated tables and the user can start another template.
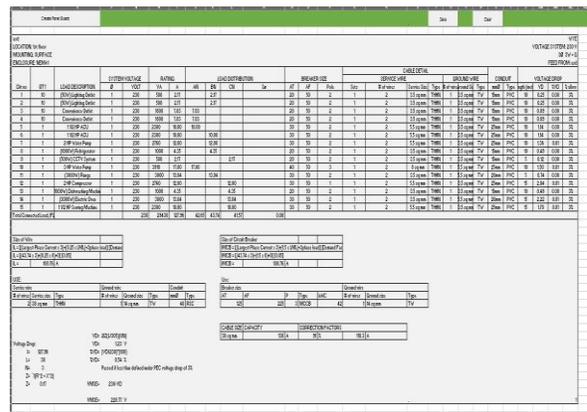

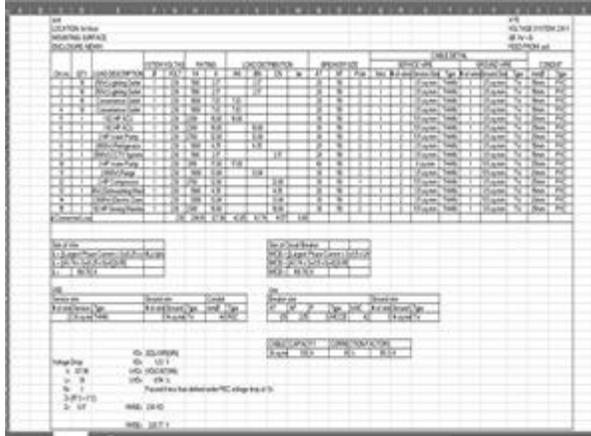Figure 4.2: Three-phase Template Calculation

Figure 4.3: Three-phase Manual Calculation

The three-phase template and manual computation are compared in the figure above. The three-phase balancing of loads in manual computations must be configured by the user manually, whereas in the template it balances in the nearest possible number automatically.

The output of this study can be considered innovative since it allows electrical practitioners to streamline their work. The user will not have to manually check the PEC 2017 book since all required information is programmed into the application, and the mechanics of the template are simple to understand. The user will no longer have to spend time building tables, as the template will do it for them. The formulas are also built in, eliminating the need to enter and solve for them individually. The template is dependable and efficient in developing an electrical load schedule, and it is appropriate for use among licensed electrical practitioners.

Result of the Template

The created electrical load schedule template was assessed by ten (10) qualified electrical practitioners during the assessment procedure. The electrical practitioners were given the software to assess the template. The researchers employed a quantitative product assessment sheet to analyze the efficiency and dependability of the created electrical load schedule template. The respondents were asked to rate the template on an assessment sheet in order to determine its quality.

Statement	Evaluators										Mean	Interpretation
	1	2	3	4	5	6	7	8	9	10		
1. The data provided by the template in selecting the right materials are accurate.	4	4	4	3	4	4	5	4	4	5	4.1	Agree
2. The computations' outcomes are precise.	5	5	4	4	5	5	5	5	5	4	4.7	Strongly Agree
3. The template can potentially lessen work in designing electrical load schedules.	5 5	4	3	5	4	3	4	3	4		4.0	Agree
4. The users can easily understand the mechanism of the template.	5 3	5	4	3	5	4	4	5	3		4.1	Agree
5. The outcome on the template shows a reasonable range of variation.	4 4	4	4	4	4	4	5	4	4		4.1	Agree
6. The template is capable of generating data that will be of value for practical use.	5	4	4	4	3	5	5	4	4	3	4.3	Agree
7. This template can be recommended to another electrical practitioner.	4 4	4	4	4	5	4	5	4	3		4.1	Agree
	Grand Mean:										4.2	Agree

Legend:

Scale	Range	Interpretation
1	1.49 and Below	Strongly Disagree
2	1.50 to 2.49	Disagree
3	2.50 to 3.49	Undecided
4	3.50 to 4.49	Agree
5	4.50 and Above	Strongly Agree

Table 1. *Structure of the Electrical load Schedule Template*

Table 1 shows the results of the assessment of the template. The results from six out of the seven statements each resulted in a mean between 4.0 - 4.3, which implies that the respondents are in agreement with the statements. The remaining statement (Statement 2) resulted in a mean of 4.7, meaning the respondents strongly agree with what was written.

The grand mean of the results is 4.2, which according to the scale, can be interpreted as Agree. This means that based on the respondents' assessment, the template selects the materials accurately. The computations of the electrical load schedule are precise due to the fact that the template's results demonstrated a reasonable range of variation. The developed template also has the potential to lessen the work in designing electrical load schedules. And lastly, the template is recommendable to other electrical practitioners since the template is capable of producing data that yield similar results as manual computation but with less time and hassle. On the other hand, the respondents suggested using 2 decimal points, breaker placement will be generated as well, avoiding the redundancy in requesting the demand

factor, and using a simpler option when selecting the power system to be used. These suggestions were taken into considering for the improvement of the developed template.

IV. CONCLUSION

This paper shows that the significance of spreadsheet programs in the Electrical load schedule template and the other electrical disciplines cannot be neglected. Microsoft Excel is the most distributed spreadsheet software package calls for attention because of its strength and relatively easy use. It is suitable for both practical and educational purposes given its great number of implemented functions, especially mathematical and statistical. By means of this program, it is possible to compute the electrical load schedule and analyze different events and phenomena as well as show parallel calculation results. Software extensions *(Add-Ins)* bring additional power and open new areas of application.

V. RECOMMENDATION

This topic suggests that it should cover more commercial, industrial buildings and another voltage system for single phase and three phase, since the researchers only focused on 230 Volts single phase and three phase Commercial (low-rise building, small retail buildings), Institutional (small government buildings, school buildings), Industrial (small manufacturing), and residential unit's electrical load schedule. Because the said template is only limited to those factors, single line diagrams and riser diagrams should be considered, as well as an undo option. Updated electrical equipment should also be considered as it varies with respect to time. Also, it is recommended for this template to be developed more so that it can also enhance into a better program.

VI. ACKNOWLEDGEMENT

REFERENCES

[1] Innovation by (and beyond) the numbers: A history of research collaborations in Excel (2021). Microsoft. Retrieved October 22, 2021, Website: microsoft.com/en-us/research/blog/innovation-by-and-beyond-the-numbers-a-history-of-researchcollaborations-in excel/?fbclid=IwAR00VwopwmvbBxsc9D9_vOKEOnr0eoiUV1VmwhqOQhsDAgBBTa4qkt287cE

[2] ADEBISI, J. (2013). Microsoft Excel. Retrieved October 22,2021, Website: https://www.researchgate.net/publication/258339298_MICROSOFT_EXCEL

[3] Institute of Integrated Electrical Engineers of the Philippines (2017). Philippine Electrical Code Part 1 (2017 Edition). *Publication Manual of the* Institute of Integrated Electrical Engineers of the Philippines, Inc. (2017 ed., p. 1).

[4] The Guidelines Project (2017). Development Research. Retrieved October 28, 2021, Website: http://www.guidelines.kaowarsom.be/annex_development_research

[5] Richey, R., & Klein, J. (2014). Design and Development Research. In M. Spector, D. Merrill, J. Elen & M. Bishop, Handbook of Research on Educational Communications and Technology (4th ed., pp. 141-150). London: Spring e**r.**

[6] Stange J. et.al (2011). Tourism Destination Management (Achieving sustainable and competitive results.) Retrieved December 10, 2017, Website: file:///C:/Users/DELL/Pictures/Camera%20Roll/New%20folder/DMOworkbook_130318.