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Development of User Interface for Onsite Dispersion Code ARCON 96

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1. INTRODUCTION

The ARCON96 code is used to calculate onsite air dispersion factor. The code is optimized for a NRC licensed air dispersion model and also to evaluate onsite atmospheric relative concentration. But this code is runs on command prompt in WINDOWS system and has limitations in several functions. The limitation is absence of input data production and pre-processing functions, so separate input production is required. In addition, since it is not a visual environment, interworking and interface may be a little difficult.

In this study, the visual user interface for ARCON96 is developed to make a program easier to use by reinforcing functions and converting it to a visual environment. Improvement in input preparation and visual environment are developed.

2. METHODOLOGY

2.1. General Process of ARCON96 Calculation

The general calculation process of ARCON96 can be divided into 3 parts. The first is to read the input values required for calculation, and the second is to classify the read values and place them in the steps required for calculation. Finally, the third is to write the calculation result and arrange the values by type and pattern.

In these three processes, pre-processing of input data and visual environment for output results are needed. The reason is that the calculation process can be made more efficient through the correction and supplementation in the process of input/output and the intermediate process of the calculation process.

ARCON96 code has several possible modeling process which are dispersion release modeling, vent release modeling and stack dispersion modeling. If a release height point is lower than 2.5times of the near structures height, it is assumed by 10m height release (ground release). According to NRC's review, this modeling is rather conservative comparing with the case of the vent height being lower than 2.5times of any adjacent structure height. ARCON96 does not use the plum rise, so a ground level release is the significant dispersion model. This approach is more conservative than any other similar to plum rise model. In this study, these modeling process is carried out by visual environment using input table.

2.2. Basic Concept for User Interface of ARCON96

For user interface of ARCON 96, several strategies were chosen. The first is to create an input preprocessing module. The second is to find and link the file to retrieve the input preprocessing results. The third is to provide a visual environment that connects the calculation and output processes.

The detailed method for each step is follows as below:

a. Input preprocess module is made by PERL script. PERL script is designed to create input matrix and to save the txt file of input.
b. Visual environment is created by PASCAL compiler (RADStudio Rio 10.3 Version).
c. Visual environment connects the ARCON96's calculation function part and the input preprocessing part and writes the calculation results. In addition, geometric main input should be modeled in figure design part.

3. CODE MODIFICATION

3.1. ARCON 96 Calculation Process

ARCON96 calculation process consists of three parts as shown in Figure 1. In Figure 1, the preparing part is the function that makes the input statement by preprocessing the input data, the ARCON96 part is the function where the actual calculation is made, and the output part is the function that writes the calculation result. In particular, the ARCON96 part performs only the function of calculating the onsite atmospheric diffusion factor. Finally, the function part of generating input format is consist of three sub parts separately as shown in Figure 1.

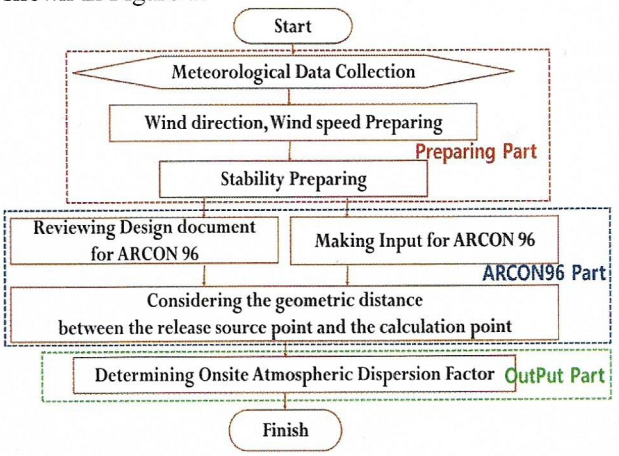

Fig. 1. ARCON96 main structure and sub parts

In this study, input generation and preparing part is added and linked to ARCON96.
And the integration environment of preparing part, ARCON96 main body, calculation results and output results is introduced from this study.

3.2. Calculation Process Modification

ARCON96 does not have the ability to generate an input statement. However, it has the function of receiving input statements, calculating and writing output. For this reason, the input statement generation is configured to use the PERL script.

After that, executable file generated from PERL generate input matrix and ARCON96 performs the calculation function from input matrix.

4. RESULTS AND DISCUSSIONS

4.1. Visual Environment Development for ARCON96

The current version is designed to be started only in the command prompt environment. In this study, using the Pascal compiler, visual environment is generated combining current ARCON96.

Fig. 2 to Fig. 5 are the developed visual interface of this study. The Figures are default screen, matrix connection screen, geometric input screen and modeling/output screen relatively.

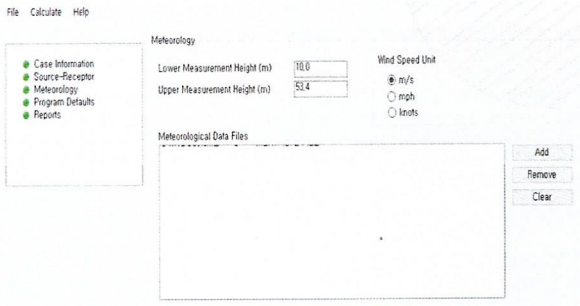

Fig. 2 Default screen of ARCON96 in windows

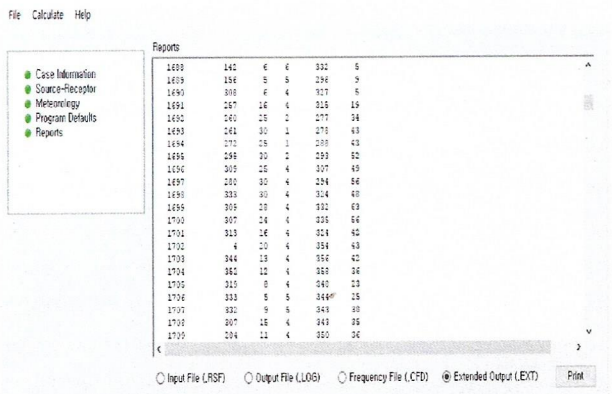

Fig. 3 Input matrix screen of ARCON96 in windows

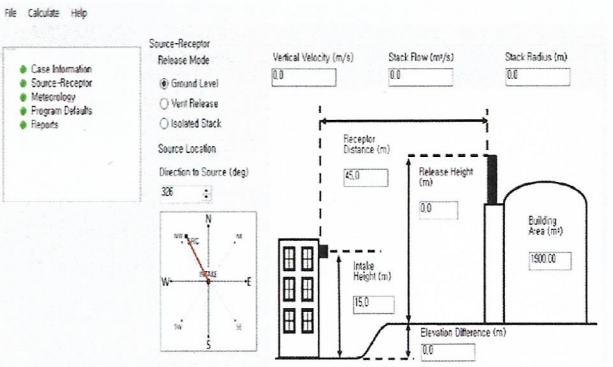

Fig. 4 Geometric input screen of ARCON96 in windows

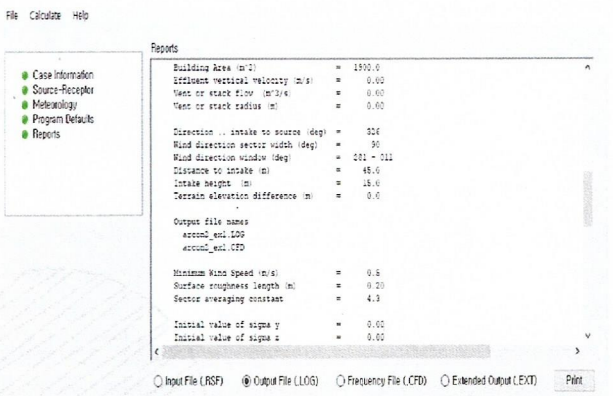

Fig. 5 Calculation and output screen of ARCON96 in windows

4.2. Performance Test

In order to verify the performance of ARCON96, the comparing results between the visual version (in this study) and the command prompt version (current ARCON96) carried out using sample input. Figure 6 is the evaluation result of the existing command prompt ARCON96, and Figure 7 is the evaluation results of the visual environment ARCON96 of this study.

These evaluation results are compared in Table1. It can be seen form Table1 that the results are same, and the performance is preserved in the visual environment.

ABOVE RANGE	0.	0.	0.	0.	0.	0.
IN RANGE	1711.	2110.	2823.	3843.	4635.	6172.
BELOW RANGE	167.	423.	551.	654.	660.	375.
ZERO	6872.	6209.	5352.	4197.	3442.	2169.
TOTAL X/Qs	8750.	8742.	8726.	8694.	8737.	8716.
% NON ZERO	21.46	28.98	38.67	51.73	60.60	75.11

95th PERCENTILE X/Q VALUES
2.01E-03 1.96E-03 1.90E-03 1.80E-03 1.52E-03 1.09E-03

95% X/Q for standard averaging intervals

0 to 2 hours	2.01E-03
2 to 8 hours	1.73E-03
8 to 24 hours	7.37E-04
1 to 4 days	5.07E-04
4 to 30 days	2.73E-04

HOURLY VALUE RANGE

	MAX X/Q	MIN X/Q
CENTERLINE	9.35E-03	5.91E-31
SECTOR-AVERAGE	5.80E-03	1.37E-31

NORMAL PROGRAM COMPLETION

Fig. 6 Calculation result of ARCON96 (current version)

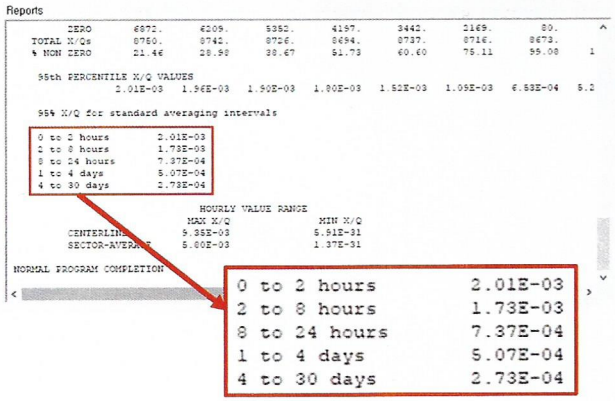

Fig. 7 Calculation result of ARCON96 (this study)

Table 1. Performance Test (Current version vs this study)

Time (hours)	Current Version (Command prompt)	This study (Visual environment)
0 ~ 2	2.01e-03	2.01e-03
2 ~ 8	1.73e-03	1.73e-03
8 ~ 24	7.37e-04	7.37e-04
24 ~ 96	5.07e-04	5.07e-04
96 ~ 720	2.73e-04	2.73e-04

5. CONCLUSIONS

The existing ARCON96 code is a program developed to start only at the command prompt. In this study, the user interface for ARCON96 was developed to window visual environment. And the input preprocessing, which was not present in ARCON96 is added. For input preprocessing, the executable file generated by PERL programming.

In comparing the ARCON96 operating in the visual environment with the current version, the evaluation results between the current version and this improved program are same.

Therefore, it is confirmed that ARCON96 of visual environment developed in this study is acceptable.

REFERENCES

[1] USNRC, "Atmospheric Relative Concentrations in Building Wakes", NUREG/CR-6331, May (1997).
[2] Seung Chan LEE et al, "Onsite Atmospheric Dispersion Factor in OPR1000 NPP in KOREA" *Transactions of the Korean Nuclear Society Spring Meeting* (2018).