A Questionnaire Survey on Cold Weather Concreting in Mongolia

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Cold Weather concreting Mongolia Questionnaire
Norm and regulation

1. Introduction

Mongolia is the second-largest landlocked country in the world with a total area of 1,566,500 km². Ulaanbaatar, the capital and the largest city, is home to about 45% of the country's population. It is the coldest capital city in the world. The city experiences an annual average temperature of −1.3°C. Temperatures in January are as low as −36 to −40 °C. Average temperatures over most of Mongolia are below freezing from November through March. Winter nights can drop to −40 °C in most years.

The limited time to complete the concrete works due to extreme climatic conditions is an urgent issue in the construction industry development of Mongolia. The main problems associated with cold weather are frost damage to immature concrete and slow gain in strength leading to later demolding times and the possibility of increased damage when the molds are removed. However, the industrial demands for cold weather concreting become growing and challenging, because of Mongolia's brilliant industry of mining such as Oyu Tolgoi copper mine, which operates concrete works for 365 days with no break. Under the above situation, an in-depth study on concreting in cold weather is an indispensable task, which should pay attention of generation to generation, keeping compatibility with technological developments and industrial demands.

The purpose of this report is to summarize the questionnaire survey of cold weather concreting in Mongolia based on the results of interviews for understanding the current situation.

2. Outline of questionnaire survey and interview with Mongolian companies

The authors conducted a questionnaire survey accompanied with interviews on cold weather concreting in Ulaanbaatar in 2020. The list of respondents is given in Table 1. Seventeen responses were collected from specialists, general engineers and directors who have experience with cold weather concreting. They are employees of construction companies, ready-mixed concrete companies, precast concrete companies, consultants and governmental entities.

A questionnaire consisted of open-ended, closed-ended and multiple choice 10 questions, which were uniquely prepared by the authors was used in this survey. The priority has given to make certain of the following matters: 1) Sufficiency of Mongolian norms for cold weather concreting, 2) Whether they execute concrete work during the winter, 3) Definition of border of the cold season for concreting, 4) What items should be included in the Mongolian norms.

3. Results

3.1 Sufficiency of Mongolian norms

All companies are referring the Mongolian norms and regulations for the cold weather concreting. Unfortunately, most of respondents answered that Mongolian norms and regulation are not sufficient for the cold weather concreting (Fig-1). The answers regarding cold weather concreting in winter season, which were obtained from non-governmental and government entities, have insisted that the quality of concrete cannot be controlled during winter season same as other seasons. Therefore, government entities are not allowed to execute concrete works during winter season due to the reasons of durability of cold weather concrete is uncertain and strength development is very much depended on ambient temperature.

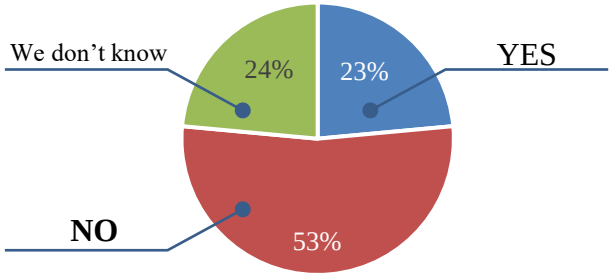

Fig-1. Do Mongolian norms sufficient for the cold weather concreting?

3.2 Whether they execute concrete work during the winter

Although the Mongolian norms are recognized insufficient as above mentioned results, the most of construction companies and ready-mixed concrete companies answered that quality of concrete can be controlled same as the other seasons during winter season. Therefore, most of them execute concrete work during winter season (Fig-2).

Table 1. List of respondents

Type of the enterprise		Construction company	Precast concrete company	Ready-mixed concrete company	Consulting, non-governmental entity, government entity	TOTAL
Number of companies		6	3	5	3	17
Number of respondents	Director	3	1	-	2	6
	General engineer	2	2	-	-	4
	Engineer	1	-	5	-	6
	specialist	1	-	-	1	1

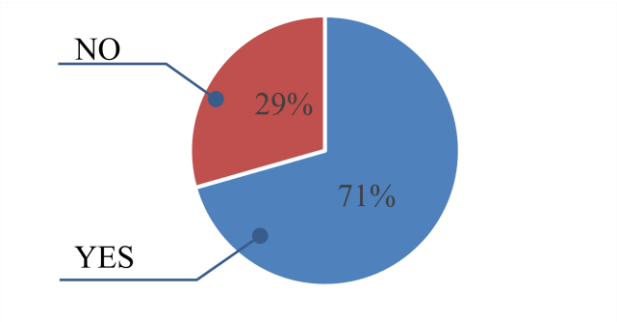

Fig-2. Do you execute concrete works during winter season?

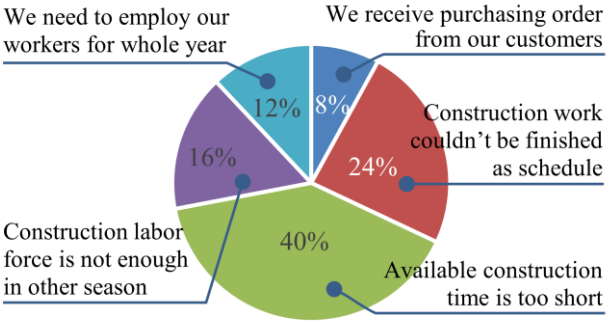

Fig-3. Why execute concrete works during the winter season?

The main reason of executing concrete works during winter season is available construction time in Mongolia is extremely short and construction work could not be finished as scheduled (Fig-3).

3.3 Definition of border of the cold season for concreting

According to the current Mongolian norms, the cold season is recognized when daily average temperature is below 5℃. Unfortunately, most of respondents continue the concrete works until middle of November or until the lowest temperature reaches -20˚C, without taking any special method for the cold weather concreting (Fig-4). For example, the AIJ standard[1)] defines the definition based on the average temperature and the accumulated temperature based on maturity. It is desirable to define a more appropriate definition for the Mongolian situation to determine the application period of cold weather concreting.

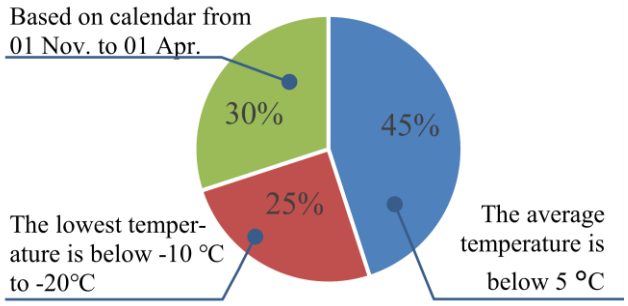

Fig-4. How do you decide start and end of the winter season?

3.4 What items should be included in Mongolian norms

As mentioned by respondents, current Mongolian norms and regulations are not sufficient for the cold weather concreting due to detailed methodological guidelines and detailed rules are missing in the existing norms. Additionally, they mentioned that necessity of establishing a new national norm based on the norms of cold countries such as Japan, Russia, North America, etc.

4. Conclusion

Following conclusions can be drawn from questionnaire survey.

1) All respondents insisted that the insufficiency of consensual Mongolian norms for cold weather concreting due to detailed methodological guidelines and detailed rules are missing in the existing norm.
2) This survey revealed that there is a large inconsistency among the stakeholders when defining the border of the cold season for concreting.
3) However, the survey revealed that the construction works are executed at temperatures between -10˚C to -20˚C, without taking appropriate actions which should be taken for concreting in cold weather.
4) The respondents answered that available construction time in Mongolia is too short and construction work could not be finished as scheduled as the reasons for off-season concreting.

References

1) AIJ: Recommendation for Practice of Cold Weather Concreting, 2009

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