Standards for wind effect on structures and environment in Indonesia

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ABSTRACT: Indonesia is a tropical islands country around the equator. The equatorial line divides the climate environment into northern and southern region. There are no regular typhoons or tornados. In spite of that, wind codes are always required to ensure that any built structure remains aerodynamically stable and safe at the highest possible wind speed. Wind effects are also a serious issue, because there is almost no control of air pollution. The following report will describe the current status of Indonesian code on wind loading and environment.

KEYWORDS: standardization, wind environment, wind effects on structure, housing, buildings, longspan bridges

1 INTRODUCTION

It is a great environment in Indonesia, being the country in the equatorial, the wind environment behaves well. Actually, no regular typhoons occurs in this region. Only a few hazards are reported, due to irregular typhoons. However, the enormous numbers of settlements on long beaches, small islands, urban flats as well as high lands of Pacific Rim mountains, seem to be a lot to deal with respect to wind.

There are various attempts to standardize codes for construction industries in Indonesia: buildings, housings, bridges, highways, railways or airports. This is motivated by the lack of expertise of most local or remote governments, particularly to cope with wind related problems.

Previously, the codes were prepared by several ministry offices. Most of the construction codes are prepared by the ministry of Public Works. The environmental codes are controlled by the ministry of Environment, Transportation, Trade and Industries, or the Agency of Assessment and Application of Technology.

Now, since the establishment of the Agency for National Standardization (BSN) in 1997, all existing codes are re-organized and directly controlled by BSN. The formal codes are published as Indonesian National Standard (SNI).

Although, several standards are published every year, the number of standards on wind effect on structures and environment are still limited to simple regular buildings, substandard housing, urban living in rise-up housings (flats), or NOx pollution. No actual standards or guidelines for specific structure, for instance the design code of: longspan bridges, high rise buildings, factory chimneys or industrial estates exist. Additionally, there are a few standards for internal ventilation and fire protection inside buildings.

A national problem is forest fire hazards every year. Smoke pollution is spread over the region, even into neighboring countries: Malaysia, Singapore and Philipine. Despite of the dryness of forest plantations and peat moss, during the dry (summer) season

between April and September, the coal base lands in Kalimantan and Sumatra sometimes are set into fires.

2. NATIONAL CAPABILITIES AND FACILITIES

The national code for wind effect on structures and environments are managed by the Agency of National Standardization (BSN) and implemented as Indonesian National Standard (SNI).

The codes are prepared by technical teams from various supported experts and contributors:

- University researcher
- Research institutes
- Ministry experts
- Private company experts

In addition, the government of Republic of Indonesia has also established a national research center to support the industrial research and standardization, which is called PUSPIPTEK in Tangerang-Banten.

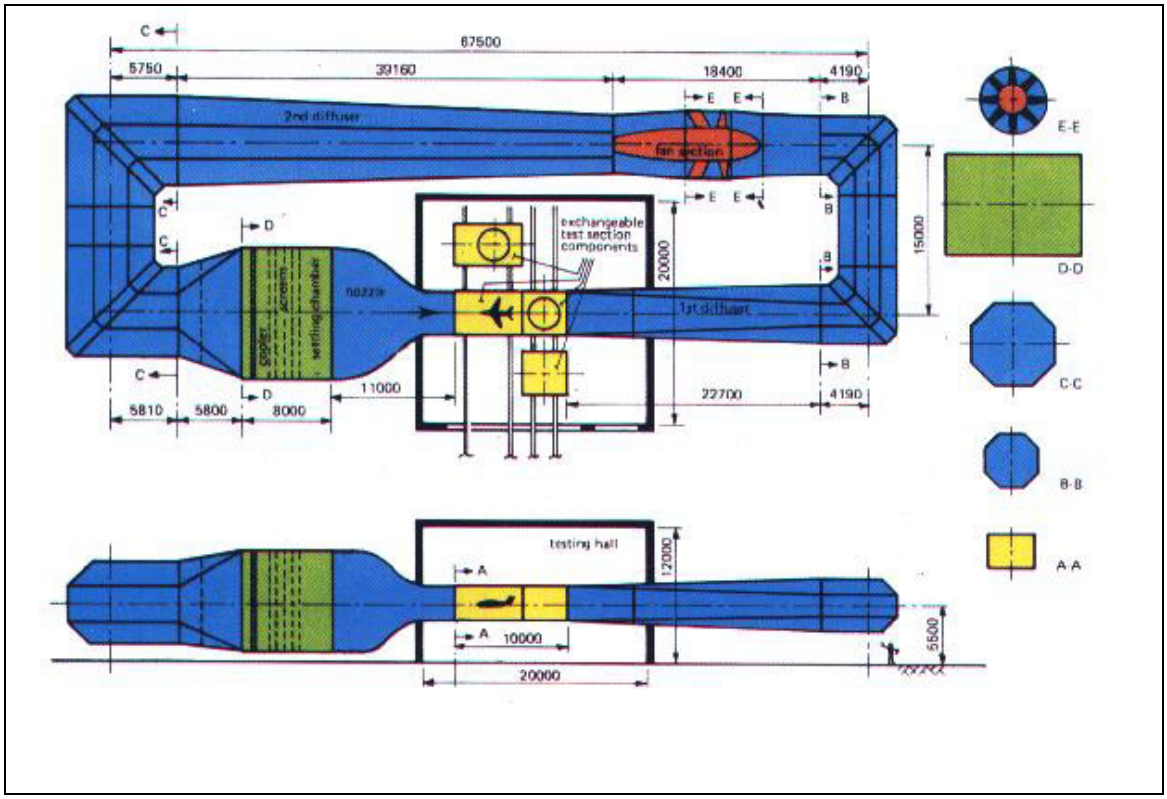


Figure 1. Layout of Indonesian Low Speed Tunnel (ILST)

LAGG (Laboratorium Aero-Gas dinamika dan Getaran) is a laboratory for aerodynamics, gasdynamics and vibration, located in PUSPIPTEK, operates an industrial wind tunnel, the Indonesian Low Speed Tunnel (ILST), where testing on aerodynamic loads and wind effects is frequently executed.

The Indonesian ILST is a closed circuit type with a standard test section (H x W x L) of 3m x 4m x 10m and a maximum windspeed of 100 m/sec. There are four

interchangeable test sections of various dimensions, to achieve a so- called multipurpose wind tunnel for testing a model of an aircraft or non aeronautical structures.

The flow can be a smooth (laminar) or a turbulent one. The turbulent flow is generated by an Atmospheric Boundary Layer (ABL) system and is properly scaled and suitable to test full aero-elastic models of a bridge or to investigate the environment around and the response of high-rise buildings.

Figure 2. A long span bridge model in Indonesian Low Speed Tunnel (ILST)

2 WIND EFFECT ON STRUCTURES

The following table summerizes the current available standards that are related to wind effect on structures.

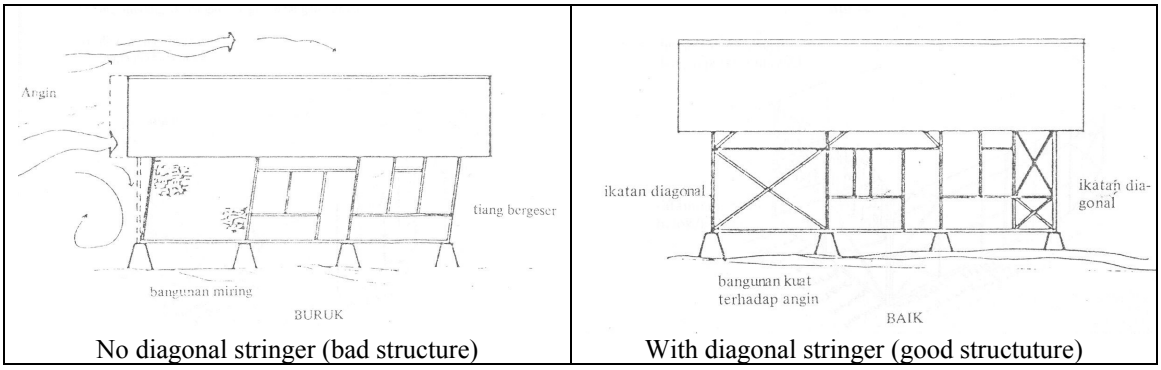
Table 1. Standards for wind effect on structure

SNI code	Title
03-2397-1991	Guidelines for the design of a wind proof simple buildings
03-1727-1989	Guidelines for the load design of houses and buildings
03-1733-2004	Guidelines for the environmental planning of urban housings
03-6981-2004	Guidelines for the planning of non-flat substandard urban housing
03-2846-1992	Guidelines for the density planning of buildings in a flat housing area
03-6968-2003	Specification of playground facility for flat housing

2.1 Housing

It is shown in the table, that most of available codes of wind effect in SNI are associated with housings, which are constructed as low or high-rise flat buildings. Actually, the flats are only build in big cities, whereas the majority of Indonesian are living in non-flat (low) housings.

The SNI 03-2397-1991 was prepared for several objectives: to secure the people in a windy area, to reduce the loss and to wind hazards, to increase the peoples knowledge on a wind proof structure and to increase the quality of housing. Although, this standard is no calculation at all, the contents are complete enough on guiding designers and builders to understand the basic knowledge of wind effects. Various typical simple buildings in Indonesia are presented, including the construction techniques.



No diagonal stringer (bad structure) | With diagonal stringer (good structuture)

Figure 3. Example of SNI 03-2397-1991 description

On the contrary, the SNI 03-1727-1989 describes more detailed procedures, though no explanations on the sources of formulas, tables and drawings is given. The scope of contents seems to be limited to simple buildings. Most of wind loads are represented as coefficients of influences.

The other SNI standards are related to high rised (flat) housing, where the quality of life as well as environmental health is the main concern of the government standard. Actually, this typical housings are relatively new to Indonesia, even in the capital city of Jakarta, only a several locations have flat housing.

2.2 High Rise Building

There is almost no standard for this, despite the increasing number of high rise buildings in the cities of Indonesia.

The current available standards for high rise buildings are only related to fire protection. Therefore, the applicable standard for design and construction of high rise buildings are adopted from USA, Europe or Japan codes. Even the testing and analysis of dynamic models are performed abroad.

2.3 Long-span Bridges

As an islands country, the construction of long span bridges is really important in Indonesia. The economy of remote islands can be boosted accordingly. However, Indonesia has to solve several technical issues as well as financial sources. By the increasing number of long-span bridges, the need for codes or standard guidelines will be essential in the future.

No formal code is available. The current code for the construction of the existing bridge came from the foreign sponsor.

3 WIND EFFECT ON ENVIRONMENT

The following table summerizes the current available standards that are related to wind effect on the environment.

Table 2. Standard on air environment

SNI code	Title
19-1128-1989	Test Techniques for dust level in a chimney
19-14004-1997	Environmental management system: general rules, fundamentals, system and supporting techniques.
19-1502-1989	Simultaneous test techniques of Nitrogen Oxides in open air and work place environments

3.1 Pedestrian Level Winds

This code is not available in SNI. Although, the effects are already found when pass through roads in the city of Jakarta.

The ILST was also performed the typical test for the building, pedestrian and Street of Thamrin in Jakarta.

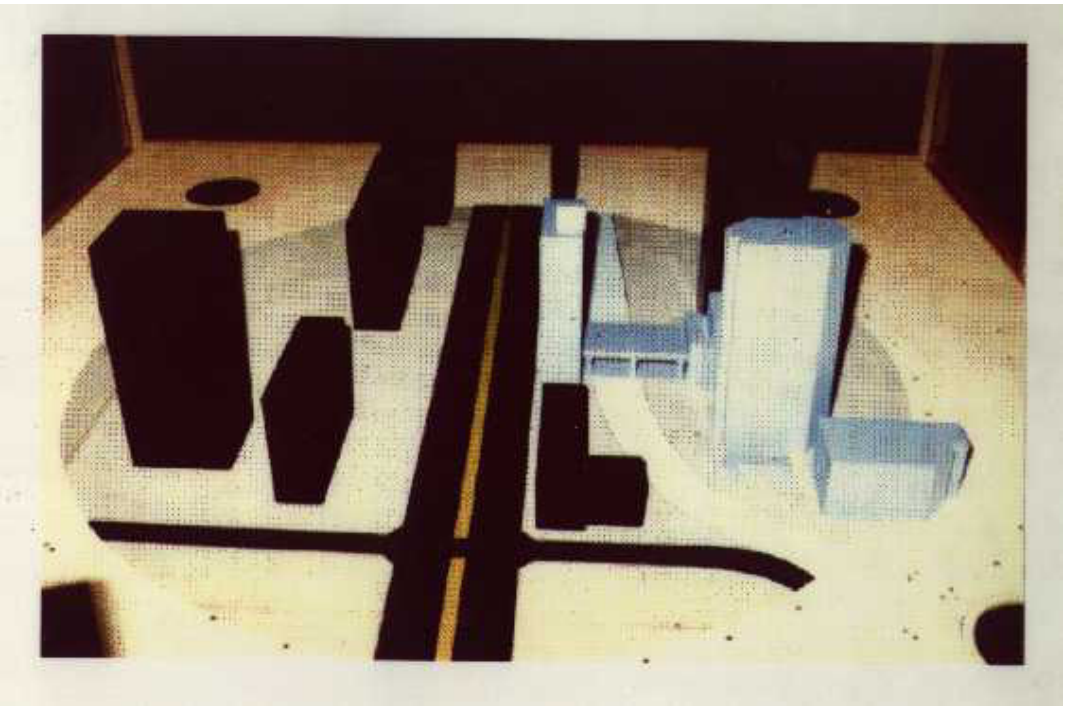


Figure 4. A road, pedestrian and building model in Indonesian Low Speed Tunnel (ILST)

3.2 Pollutant Dispersion

There are proposals to control various air pollution problems in Indonesia, particularly in big cities and industrial estates. However, the actual implementations are still a long way.

In 1992 the ministry of environment released a proposal for controling the air pollution, which is called The Blue Sky Program[10]. It is an integrated program to harmonize various codes from several ministries which relate to air pollution control.

The available standards are be relevant only to diffusion of chemical particles (SNI 19-1502-1989 and 19-1128-1989), no wind effect discussion on air pollution. Only a few researchers think about wind effect on air pollution.

The SNI 19-14004-1997 was intended to provide a general guideline that can be implemented in any institution, company or local government. It does not relate to other standard or obligatory to follow.

Some researches or scientific investigations on pollutant dispersion in Indonesian big cities have been done. To some extent, ILST is also able to test the dispersion model. Up till now, only a few formal code or SNI are available to control the air pollution.

3.3 Forest Fires

This is a real big problem every year, the smoke of fire has frightened people in the surrounding cities. Schools and offices were closed, people were encouraged not to go outside, even several flights to the area were canceled. Up till now, no code or SNI is designed to overcome the problems.

4 CONCLUSION

There are many reasons to prepare Indonesian codes or standards. The relatively new standardization agency is having a big task to accomplish. The code for wind effect on structures and environment are the most important standards to prepare.

International conferences or workshops will help the upcoming Indonesian standard to be accepted not only in the country but also by the neighbouring countries.

There is still a shortage of standards for wind effect on structures and environment: long-span bridges, high rise building, chimney, industrial estate, air pollution control, vehicle exhaust systems, work environment, and urban housing.

As a developing country with a huge population, the implementation of the code is also important to emphasize. Several codes are not properly implemented. It seems that the user does not have the obligation to follow the rules.

Currently, it is the intention of the government of Indonesia to implement rules for the wind effect on structures and environment for low income people, who living in high rise flats. The quality of life, health and socioculture will directly be connected to the enforcement of the wind effect on structures and environmental codes.

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