

Talk on “MS 1314:2004 Precast Concrete Piles”

By: Ir. Dr Jeffrey Chiang Choong Luin

Date : 24 July 2004
Time : 9.00 a.m. to 12.30 noon
Venue : IEM Conference Hall,
Bangunan Ingenieur,
Petaling Jaya

Introduction

The talk, which was organised by IEM Civil & Structural Engineering Technical Division, commenced at 9.30 a.m., with 37 participants having registered, and after having their morning tea and refreshment. The then Deputy Chairman of the Technical Division, Ir. Li Thang Fai, who was chairing the proceedings, gave a welcoming address, and introduced the speaker.

Talk on “MS 1314:2004 Precast Concrete Piles”

The talk was presented by Tuan Haji Yahya bin Haji Ariffin, the Director of Certification, IKRAM Quality and Certification Institute. He has also served as the Chairman of the Technical Committee for the revision of MS 1314, formed and directed by the Industrial Standards Committee (D) of SIRIM Bhd. The co-speaker for this talk was Ir. Yue Kam Fatt, the Secretary of Working Group 4 of MS 1314:2004.

The background and issues, the formation and working of the various working groups and the scope of work involved were presented briefly.

MS 1314: Precast Concrete Piles was first published in 1993 as Part 1, and followed by Part 2 in 1996. Both Parts 1 and 2 were developed based on JKR Standard Specifications for Precast Concrete Piles in Building Projects (JKR 20709-0182-91). In general, the concrete piles currently produced in the market are those that comply to JKR Specifications, MS 1314 Part 1:1993 and MS 1314:1996, as well as those categorized as ‘commercial grade’ piles.

In the newly revised MS 1314:2004, effort has been made to harmonize the requirements of JKR Specifications, MS 1314 Part 1:1993, MS 1314:1996, and also to introduce a new standard grade ‘S’ for RC piles to provide the minimum requirement for the ‘commercial grade’ piles.

The new MS 1314:2004 is divided into 7 parts as follows:

- Part 1 : General Requirements and Specification

- Part 2 : Method for Determination of Bending Strength of Precast Concrete Piles (bend test)
- Part 3 : Precast Reinforced Concrete Square Piles (RC piles) – Classes M, J and S
- Part 4 : Precast Pretensioned Spun Concrete Piles (Spun piles) – Classes A, B and C
- Part 5 : Precast Prestressed Concrete Square Piles – Classes X, Y and Small Piles Classes PCS-1 and PCS-2
- Part 6 : Small Reinforced Concrete Square pPiles – Small Piles RCS-1 and RCS-2
- Part 7 : Guidelines to the Installation and Load Testing of Precast Concrete Piles

MS 1314 Parts 1 to 5 are currently being printed and Part 7 is still under deliberation. Part 6 is in the stage of getting Ministerial approval on the revised standard. Tuan Haji Yahya contended that MS 1314:2004 will provide a wider choice of selection of concrete piles produced by local Malaysian concrete piles manufacturers.

Some of the technical details presented include the following:

- Reduction of cement content of commercial grade piles from 450 kg per cu. m to 420 kg per cu. m, which was claimed to satisfy international material tests. Experimental results from the many series of tests undertaken at IKRAM were used as the basis for this reduction.
- Under MS 1314:Part 3 (RC piles), the minimum steel content is reduced to 0.8%, for class S piles. This mainly caters to commercial grade piles, to ensure no steel content below 0.8%. A technical report from Sweden was cited, to support this reduction, together with detailed calculations, signed by a professional engineer.
- Reference was made to MS 1314:Part 1, Clause 1.3, where the professional engineer has the responsibility to select the appropriate pile for suitable applications.
- The basis of the ‘f’ factor was explained, with regards to determining the cracking moment, with respect to ultimate moment. It is the ratio of ultimate moment (at installation/handling) to the cracking moment (which is defined as when 0.5mm cracks appear in the piles due to bending).

- The thickness of mild steel plate for pile joints are now smaller for RC pile class S, i.e. 6 mm thick for 200mm and 250mm piles, and 9 mm thick for 250mm, 275mm, 300mm and 325mm piles.

After a brief insight into MS 1314:2004, participants were served coffee and refreshments at 10.30 a.m. The talk resumed at 10.45 a.m., in which, Ir. Yue Kam Fatt, the Secretary of Working Group on MS 1314: Part 4 (Spun piles), was the designated speaker. He presented the details of some pertinent aspects of MS 1314:Part 4, such as prescribed concrete strength (60 MPa for all three classes A, B and C), yield strengths (4.0, 5.0 and 7.0 MPa, for classes A, B and C respectively), and cement content of 420 kg per cu. m for all classes A, B and C.

Other technical details presented include:

- Concrete strength at transfer of prestress to be at 30 MPa
- The ‘f’ factor to be of 1.5 (for Class A and B), and 1.8 (for Class C)
- Effective prestress of 4.0 MPa (for normal piles), and 7.0 MPa (for marine piles)
- Minimum clear cover of 20 mm
- Joint plate thickness ranging from 12mm to 15mm

Tuan Haji Yahya continued the talk with emphasis on IKRAM as a quality assurance and certification body for both the government agencies and private sectors.

During the Q&A session, various questions and comments were raised and directed to both Tuan Haji Yahya, and Ir. Yue Kam Fatt, pertaining to application and interpretation of MS 1314:2004. The following are summarised questions posed, and responded accordingly by both speakers:

- (1) What are the justifications for a reduction in cement content to 420 kg per cu. m. from 450 kg per cu. m. , especially where high concrete grade piles (e.g. 60 MPa) may be needed, such as in harsh climatic or marine environment?

Ir. Yue Kam Fatt responded by saying that many independent tests were carried out in the laboratory locally and results obtained proved that 60 MPa strength – 420 kg/m³ cement content combination is deemed acceptable.

A follow-up comment was made from the floor to the Technical Committee for MS 1314:2004 in cautioning them that laboratory tests are not true representation of conditions on site. Performance of piles on site may have to be checked and assessed, over a period of time, before such test findings are deemed acceptable.

- (2) What kind of tests were carried out on piles to check the requirements for strength and durability of precast piles?

No direct response was made to this query, although Ir. Yue Kam Fatt clarified that concrete grades for piles may have to be increased for severe soil and exposure conditions, since MS 1314:2004 only covers pile exposure to mild and moderate soil conditions. Tuan Haji Yahya commented that MS 1314:Part 1, Clause 1.2(c) has provisions for exposure to severe soil conditions, where compliance to MS 1195:1991 (concrete design standards) is required.

A follow-up comment from the floor: The Clause 1.2(c) provision is not clearly highlighted, or was it added in as an after thought? Tuan Haji Yahya agreed to take into consideration of this comment, in the next revision of MS 1314:2004.

- (3) Is MS 1314:2004 a product specification, and not a structural or materials code of practice? The provision is not clearly spelt out on the role and responsibility of engineers in specifying the concrete piles, as part of structural design, particularly Cl. 1.3 (Part 1) – what can be done to rectify this?

Tuan Haji Yahya concurred that MS 1314:2004 is indeed a product specification, and is not to be used as a design code of practice as such. Nevertheless, professional engineers will be held responsible in selecting the right piles for installation and commissioning, as per Clause 1.3 in Part 1. Again, Tuan Haji Yahya promised to re-look at highlighting this aspect in the next revision of MS 1314:2004.

- (4) What are the formulas used to determine the cracking moment, and what is the basis of derivation? Both Tuan Haji Yahya and Ir. Yue Kam Fatt have earlier presented the calculations for cracking and ultimate moments, not in detail, but in a summarized and tabulated form, only for RC square piles (Classes M, J and S) covering steel ratios of 0.8%, 1.0% and

1.2%. Should any participants wish to get detail information of formulas and calculations done, they may contact the TC Secretariat directly at SIRIM Bhd.

- (5) In high steam and high temperature curing process of concrete piles, i.e. autoclaving (which is of Japanese origin), how are delayed shrinkage and cracks formation controlled or remedied?

Ir. Yue Kam Fatt informed the participants that this method of curing is used mainly for very high concrete grade of piles, such as 80 MPa. Ofhand, Ir. Yue could not reply to this question, in terms of cracks and shrinkage control. Ir. Yue will try to obtain further information and convey to IEM. He stated that the maximum temperature used in autoclaving is 180°C at a pressure of 10 bars.

- (6) What is the actual definition of cracking moment, and ultimate moment terms as used in MS 1314:2004 in determining the ratio, 'f' factor?

Elaborating further on the presented facts by Tuan Haji Yahya, the THEN IEM C&S Technical Division Chairman, Ir. MC Hee suggested that in BS 8110 and ACI 318, the cracking moment is defined as the moment in structures in which the tensile capacity has been exceeded – in which cracks start to form. On the other hand, the definition of cracking moment in MS 1314:2004 is slightly different, in the sense that it is the moment experienced in structures where a certain crack width has formed. The MS 1314 drafters then back calculated to get the required 'f' factor of 1.5 to 1.8, based on this definition. It would not be correct to relate these 'two' cracking moments as to mean the same thing.

- (7) Questions on steel ratio reduction to 0.8% (for commercial grade concrete piles) and the use of 6mm and 10mm thick mild steel plates at pile joints are raised for further clarifications and justifications, were posed to Tuan Haji Yahya – who was informed that Swedish Standards actually specify a steel ratio of 1.2% and not anything less than 1.0% as suggested.

Tuan Haji Yahya referred to MS 1314:Part 7 on installation of piles, in which only qualified welders are specified. He further stated that, not only bend tests but joint tests were also carried out on piles to study the effect on 6mm and 10mm plates, beyond ultimate strength, and no failure in the

joints were observed. Tuan Haji Yahya also clarified that the ultimate moment in this case is referring to loading experienced by piles during handling and installation stages, not for structural loading capacity.

He also stated that the recommended steel ratio of 0.8% is only allowed for commercial S grade piles. Steel ratios for other classes of piles (M and J) are maintained at or above 1.0%. Its purpose is to ensure that pile manufacturers should not go any lower than 0.8% for the commercial grade piles – as are prevalent now in the market. Nevertheless, the professional engineers are still given the authority and responsibility to accept or reject piles, which are not deemed acceptable for safety reasons.

- (8) In Table 2 of MS 1314:2004, Part 1, a crack width of 0.2mm is allowed for RC piles, and a question arise on whether this is applicable for use in severe soil conditions?

Both speakers suggested that the allowed crack is more for the purpose of handling and installation of piles, i.e. in particular the calculation for engineering Mult and Mcr. This crack allowance is also stated in BS 8110 for concrete design.

In a point of clarification, Ir. MC Hee remarked that the 0.2mm crack width allowance is not acceptable, especially for piles to be installed and commissioned for use in severe ground conditions, where steel reinforcement may be exposed to such elements. The requirement in BS 8110 is applicable only for structural buildings or superstructures.

As time did not permit for the Q&A session to continue, the Chairman of the session suggested that any further queries can be directed officially to the TC Secretariat at SIRIM Bhd, or unofficially to Tuan Haji Yahya and Ir. Yue Kam Fatt personally, who welcome any suggestions which can be used to improve the technical content and presentation of MS 1314:2004.

At the end of the Q&A session, the talk was formally closed by the session Chairman, Ir. Li Thang Fai, who invited the then Chairman of Civil & Structural Engineering Technical Division, Ir. MC Hee, to present tokens of appreciation to Tuan Haji Yahya and Ir. Yue Kam Fatt for their very timely and interesting talks, and their enthusiastic responses to queries from the floor.

The talk formally ended at about 11.30 a.m. ■