

Structural Eurocodes to Replace British Standards in Malaysia

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I. ABSTRACT

Prior to and since 2010 when the United Kingdom (UK) had withdrawn all British Standards pertaining to structural design, Malaysia through The Institution of Engineers Malaysia (IEM) has been taking the initiative and the lead in drafting the Malaysian Standards MS EN Eurocodes to replace the existing BS structural design standards used in the construction industry since Malaysia's Independence in 1957. By 2010, five of the Eurocode parts have been drafted into Malaysian National Annexes, relating to structure design in concrete and steel buildings. There are more Eurocode parts to be studied and adopted into the Malaysian Standards and IEM has been tasked by the Department of Standards Malaysia to continue the good work. On the implementation side, IEM is also actively promoting the use of MS EN Eurocodes by practicing engineers in the industry and academia. IEM has proposed a timeline to allow for flexibility and a transitional period for practicing engineers to familiarize themselves with the new MS EN Eurocodes before being fully adopted as mandatory standards in Malaysia. At the same time, IEM had organised a series of Awareness Seminars on Eurocodes all over the country in 2014 and continued this effort in 2015, in line with plans to hold intensive courses and workshops on Eurocode design standards for concrete and steel structures in 2015 as well as in 2016.

II. INTRODUCTION

The idea of studying the options to replace the British Standards as structural codes of practice in Malaysia came about back in 2002, through the formation of an IEM Position Paper Committee on "Design Standards for Concrete Structures in the Local Construction Industry After 2006". The Committee was chaired by Ir. MC Hee, a practicing consultant, and the author was the appointed Secretary of the Position Paper Committee. During that period, the UK had given an undertaking that they will adopt the Eurocodes as the structural design standards to replace the British Standards in use then – such as BS 8110 (for concrete structures) and BS 5950 (for steel structures).

In 2004 the IEM Position Paper strongly urged for the need to adopt the Eurocode EC2 (or to be more precise EN1992:2002) as the basis for the drafting of the Malaysian Standards National Annex. Following on from there, in 2006 the Department of Standards Malaysia (DSM) gave the approval to IEM to form a Technical Committee on Design Standards for Concrete Structures in Malaysia. After four years of hard work, the Technical Committee on Concrete Design had produced three sets of MS EN standards for the local construction

industry, and three accompanying National Annexes that went with them. They are as listed below:

- Malaysian Standards MS EN documents on design of concrete structures:
 - MS EN1990:2010 – Eurocode : Basis of Structural Design
 - MS EN1991-1-1:2010 – Eurocode 1 : Actions on Structures – Part 1-1 : General Actions – Densities, Self-weight, Imposed Loads for Buildings
 - MS EN1992-1-1:2010 – Eurocode 2 : Design of Concrete Structures – Part 1-1 : General Rules and Rules for Building Structures
- National Annexes documents on concrete structures design:
 - NA to MS EN1990:2010 – Malaysia National Annex to Eurocode : Basis of Structural Design
 - NA to MS EN1991-1-1:2010 – Malaysia National Annex to Eurocode 1 : Actions on Structures – Part 1-1 : General Actions – Densities, Self-weight, Imposed Loads for Buildings
 - NA to MS EN1992-1-1:2010 – Eurocode 2 : Malaysia National Annex to Design of Concrete Structures – Part 1-1 : General Rules and Rules for Building Structures

IEM also formed a Technical Committee on Design Standards for Steel Structures in 2007, which then developed the following MS EN documents:

- Malaysian Standards MS EN documents on steel structures design:
 - MS EN1993-1-1:2011 – Eurocode 3 : Design of Steel Structures – Part 1-1 : General Rules and Rules for Building Structures
- National Annexes documents on steel structures design:
 - NA to MS EN1993-1-1:2011 – Eurocode 3 : Malaysia National Annex to Design of Steel Structures – Part 1-1 : General Rules and Rules for Building Structures

IEM was also the main driver in a Working Group under another Technical Committee to draft the following MS EN documents on geotechnical design:

- Malaysian Standards MS EN documents on geotechnical design:
 - MS EN1997-1:2012 – Eurocode 7 : Geotechnical Design – Part 1 : General Rules
- National Annexes documents on steel structures design:
 - NA to MS EN1997-1:2012 – Eurocode 7 : Geotechnical Design – Part 1 : General Rules

Since May 2010, the UK had already withdrawn all British Standards relating to structural design and has fully adopted the use of Eurocodes in UK consultancy practice after going through a 2-year transition period. Singapore has also followed suit, and they have begun their transition period of two years commencing from April 2013, in which both the British Standards and Eurocodes can co-exist for application and submission in order to gain approval from local authorities.

The question now for Malaysia is: What are the Malaysian authorities planning to do to introduce and implement the adoption of Eurocodes in the Malaysian construction industry? And how should both BEM and IEM play its role in providing the incentive and support to

ensure that the transition from BS codes to Eurocodes can be carried out in a smooth and systematic manner?

III. SIGNIFICANCE OF THE ISSUE AT HAND – ENFORCING THE ADOPTION OF EUROCODES IN MALAYSIA

At the moment, local authorities are simply not aware of the seriousness in the switchover of design standards for structural design from BS to Eurocodes. It all goes back to the provisions in the Uniform Building By-Laws (UBBL) in which the precursor to UBBL 2012 still stipulates the use of British Standards as the de facto approved standards for submission purposes.

The custodian of the UBBL is the Ministry of Housing & Local Government, while the local authorities are the responsible parties that shall implement the policies or provisions therein. The regulatory body, BEM and the learned societal body, IEM together with the association body, ACEM had jointly submitted a recommendation to the Ministry to institute a 3-year transition period in order to allow the local practicing engineers to fully familiarize with the Structural Eurocodes prior to full adoption. The reason being that: the submission of design drawings and calculations has safety ramifications to the public and also entail legal liability to the submitting engineers.

In the most recent discussion between the Ministry of Housing & Local Government with representatives from BEM, IEM, ACEM and various officers from the states' local authorities, it was made clear by the Ministry that it is not in favour of instituting a transition period, as recommended by BEM, IEM and ACEM. In their opinion, the transition had already commenced in 2008 when the idea or proposal to adopt Eurocodes in place of BS was discussed among the industry stakeholders, with a view to revise the then Uniform Building By Laws (UBBL). To date, two states in the Peninsular, Selangor and Terengganu had gazetted the revised UBBL 2012, and hence the MS EN standards shall be used in place of BS codes in these two states. The rest of the Malaysian states have yet to gazette the UBBL 2012, and so they shall have their transition up to the time when they gazette the UBBL 2012.

IV. STATUS OF AWARENESS AND CONFIDENCE IN THE SWITCHOVER TO EUROCODES

Since mid-2014, BEM had conducted a survey among all registered professionals and graduate engineers in the industry to identify their level of awareness and confidence in the adoption of Structural Eurocodes in place of BS standards. Based on the data from BEM, a total of 1398 engineers had responded, and the results are as tabulated below:

TABLE 1: Statistical Findings of the BEM Survey (2014) on Eurocode Awareness and Confidence among Professional and Graduate Engineers

Composition of respondents	PEs 51%	Graduates 49%
Sector of employment / practice	Private 87%	Public 13%

Question posed to all registered engineers	Responded YES	Responded NO
1. Are you familiar with the application of Eurocodes or MS EN standards for structural design and construction?	36%	64%
2. Are you ready to adopt MS EN as the design standards in place of British Standards in practice?	51%	49%
3. Are your engineers and designers (subordinates or colleagues) able to follow MS EN as design standards?	48%	52%
4. Are you adequately equipped in facility / software to adopt MS EN for design of structures?	30%	70%
5. Are you ready to submit designs based on MS EN standards?	35%	65%
6. Are you aware that you can purchase MS EN standards from SIRIM (or via website www.sirim.my)?	42%	58%

The results of the survey indicate that a higher number of engineers gave negative responses to the questions posed on their awareness and confidence level in the use and adoption of Structural Eurocodes in place of British Standards. Although the findings have to be limited to the number of respondents involved in the BEM survey, nevertheless the results do not bode well for the industry if the relevant authorities insisted in enforcing the full adoption of Structural Eurocodes without considering a proper transition period, as recommended by the professional bodies.

The likely problems faced by the practicing engineers in adopting Eurocodes are as follows:

- There is insufficient in-depth awareness of the Eurocodes among practicing engineers and other users of codes of practice in the design of structures.
- The uncertainty surrounding the implementation is still prevalent, especially with the lack of decision and direction by authorities and policy makers.
- The custodian body is sending out mixed messages to the stakeholders, especially with regards to the approval or non-approval of the Uniform Building By-Laws which stipulates the list of approved standards to be adopted in the local construction industry.
- The people in charge at the top are not treating the issue of the Eurocode switchover seriously enough. The process is unclear and there are delays in responding to enquiries as to the timing to set for the switchover or whether there is a transitional period similar to other adopting countries.
- Since there is a lack of directive from the top to the various government agencies including public universities, the teaching and practice of Eurocode design standards to students and graduates of engineering is not made mandatory.

- The end results to date is that some universities are teaching Eurocodes as part of their design subject syllabus, hence resulting in graduates who are able to design according to Eurocodes but are surprised to find that the industry is still sticking to the BS codes of practice and not yet ready in switching over to Eurocodes.
- For the older and senior practicing engineers, there is no incentive to learn a new design standards or codes of practice, because the learning process is tedious and time-consuming.
- The middle-level engineers who are well-versed in BS codes have difficulty in the switchover because the prevailing perception is that it is going to be hard to learn a new design philosophy, and so far many of these engineers have not been attending the many Eurocode EC2 courses organised by IEM.

V. ACTION PLANS TO INITIATE THE IMPLEMENTATION OF EUROCODES

The intention of the three main engineering bodies (BEM, IEM and ACEM) was to institute a transition period – which has been proposed at 3 years commencing from 1 June 2014, after the issue was discussed and agreed upon by these three parties, through a joint letter to the Ministry of Housing and Local Government in April 2014. However, the Ministry is not agreeable to this proposed transitional period and has highlighted the following viewpoints:

- The enforcement of revision to UBBL is not an issue due to the use of only British Standards by industry practitioners to date.
- The period of transition has started since 2008 and adequate time has been allowed in order for practicing engineers to adopt Eurocodes in place of BS standards in use now, and there is no necessity to institute another transitional period as recommended by BEM.
- In view of the similarities in the use of BS and the new MS EN standards, there should not be any problems in implementing the adoption of MS EN, as approved by the top decision-making body in the Ministry.
- The BS can still be used as a referenced standard where there is no available corresponding MS EN in place yet.

One major flaw in the Ministry's assumption especially for the last point is when it is suggested that the old British Standards can still be used if no corresponding MS EN is in place yet. It is mind boggling to know that non-technical civil servant bureaucrats are making decisions on technical matters. It has been highlighted on numerous occasions to the Ministry that the only fallback if there is no MS EN available is to refer to the second order in the hierarchy of accepted standards, i.e. BS EN standards. And BS EN standards are also new because all MS EN standards are actually based on BS EN standards, which are in use now in the UK.

Since the Ministry has vetoed the proposal for a transition period, then the only way to assist the practicing engineers to ensure that they become well-versed in adopting Eurocodes

by organizing more training courses and seminars for both the professional and graduate engineers. So far, IEM has been taking the lead by conducting many intensive courses in the Klang Valley and awareness seminars nationwide.

VI. THE KEY DOCUMENT – THE UNIFORM BUILDING BY LAWS (UBBL)

It has to be highlighted that the construction engineering practices in Malaysia is largely governed by the provisions in the Uniform Building By Laws (UBBL) – which had its latest amendments approved in 2012. In addition, the latest amendments in the UBBL include the replacement of British Standards with Eurocodes and adopted as the Malaysian Standards, known as the MS EN standards, particularly relevant for those documents already prepared for concrete and steel design and others, as stipulated above.

Therefore, in order for the construction industry and professional engineering practices related therein to move forward, it is imperative that the Eurocodes have to be used eventually as the referenced design standards for submission purposes.

The problem here is that not all of the local authorities have started to implement the revised UBBL 2012, even though both the Selangor and Terengganu states have officially adopted the revised UBBL 2012. This has yet to be filtered down to the local authorities' level. There could be some reasons why the adoption is not implemented immediately, such as:

- It takes time and effort by the engineers and controllers in the local authorities to pick up the intricacies of Eurocodes as opposed to the much more familiar British Standards
- The documentation is still not in place and furthermore it takes time and financial resources to purchase the necessary Eurocodes standards as reference materials
- The local authorities had in mind to organise training sessions for its staff in order to make them familiar and able to use the Eurocodes as reference standards
- The local authorities have yet to receive any official directive from the State Secretariat on the mandatory use of the revised UBBL

At the moment, the Ministry of Housing and Local Government is lamenting that they are not able to enforce the revised UBBL 2012 to practicing engineers. This enforcement task is left to the local authorities, and not just one, but all local authorities which need to begin the enforcement. For example, in Selangor, the State Secretariat has gazetted the use of the revised UBBL 2012, even though there is still no printed copy of the version. As for the rest of the local authorities, for example, in Klang, Sabak Bernam and Petaling Jaya, no effort has taken off to begin enforcing the revised UBBL 2012.

VII. THE TIME FRAME FOR IMPLEMENTATION

In the letter from BEM to KPKT, the suggestion of a 3-year transition period is to commence from 1 June 2014 till the end of 31 May 2017. This will allow for adequate preparation and training of local engineers and university engineering students on the use of Eurocodes in design courses, in time for them to be ready by 2017.

It may also be advisable for the Ministry of Education to produce a directive for all local public and private universities, instructing them to conduct all design structural courses with references to Eurocodes, beginning, for example, from 2015. A two-year period should be enough to fully implement this into the teaching of relevant courses at the university level. The teaching of design courses normally starts from Year 3 onwards in a typical 4-year engineering programme, unless it is a 3-year UK-degree course – which would then have design courses taught from Year 2 onwards. This is when the use of MS EN Eurocode 2 will have to be used in the teaching of design of concrete structures, replacing the withdrawn British Standards BS8110.

The use of Eurocodes will be more prevalent when students go on to take their Final Year Projects where the use of design standards will be emphasized, and also in integrated engineering designs where multi-disciplines are involved in the design of a typical project given to groups of students most likely at Year 3.

Besides the education field, the IT software industry would also require some time to institute and to fine-tune the inclusion of Eurocodes as a design suite or package into their commercial software. In the current scenario, most if not all software packages available in the market have in place the Eurocodes as a choice of design standard for users, in order to process their analysis and design steps using their commercial products.

Last but not least are the mindsets of the engineering graduates when they are being churned out from universities into the industry. Eurocodes are here to stay, and if these graduates want to be competitive not only in the local practice but internationally, then it is imperative for them to be well-versed in the adoption and application of Eurocodes.

Figure 1 below shows a representation of the transition period with tentative timelines and milestones for Malaysia, in adopting Eurocodes as design standards in place of British Standards by 2017.

Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
			Consensus between BEM / IEM / ACEM		Start 3-yr transition EC2 / BS8110		Push for adoption UBBL by Local Auth	Awareness seminars on EC2 by IEM	Official directive from MOHLG	Official directive from MOE	
Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15
Start promotional events by DSM		All local universities come to consensus by IEM	Awareness seminars on EC2		Start trial acceptance EC2 as submission by IEM	Awareness seminars on EC2 by IEM		Intensive courses on EC2 by IEM			
Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Intensive courses on EC2 by IEM		Dialogue with cement manufacturers			DSM to review EC2 usage in industry		Intensive courses on EC2 by IEM				
Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
		Intensive courses on EC2 by IEM			End 3-yr transition EC2 / BS8110	Start full adoption of EC2			Intensive courses on EC2 by IEM		

Figure 1 – Proposed timeframe for a 3-year transition period towards full adoption of Eurocodes by 2017

On the other hand, with recent developments, the Ministry of Housing and Local Government has a different timeframe for the full adoption of Eurocodes by practicing engineers in the industry for submission purposes. One can refer to Figure 2 for their proposed transition timeframe, which is closely linked to the gazettement of the Uniform Building By-Laws 2012.

Timeframe (with transition period) for adoption of Eurocodes										
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Transition supposedly starts for all (incl. Selangor)				UBBL 2012 gazetted by Selangor	Adoption by local authorities	Full implementation				
Transition supposedly starts for all (incl. Terengganu)				UBBL 2012 gazetted by Terengganu	Adoption by local authorities	Full implementation				
NULL & VOID					Effective transition for Kelantan	UBBL 2012 due to be gazetted by Kelantan	Full implementation			
NULL & VOID					Effective transition for all other States	Adoption by other States & local authorities				

Figure 2 – KPKT interpretation of transition period towards full adoption of Eurocodes

VIII. TRAINING PROGRAMMES

Some of the more recent training seminars / courses offered / conducted by IEM solely on Eurocode 2 include the following:

- 17-18 October 2013, 2-Day Course on “Simplified Unified Practical Design to MS EC0, MS EC1 & MS EC2 From a Consulting Engineer’s Perspective”, by Ir MC Hee at Armada Hotel, PJ. (74 participants)
- 11 June 2012, 1-Day Pre CONCET 2012 Conference on “Design of Concrete Structures to EN 1992”, by Dr W M C Mckenzie, PICC, Putrajaya. (61 participants)
- 21 May 2010, 1-Day Seminar on “Adapting Eurocodes EC0, EC1 and EC2 in Malaysia” by various presenters, Dynasty Hotel, Miri, Sarawak. (36 participants)
- 10-12 March 2010. 3-Day Course on “Practical Design to MS EC0, MS EC1, MS EC2 from a Consulting Engineer's Perspective”, by Ir MC Hee at Armada Hotel, PJ. (71 participants)
- 12 November 2009, 1-Day Seminar on “Adopting Eurocodes EC0, EC1 and EC2 in Malaysia” by various presenters at Puteri Pacific Hotel, Johor Baru (73 participants).
- 29 October 2009, 1-Day Seminar on “Adopting Eurocodes EC0, EC1 and EC2 in Malaysia” by various presenters at Evergreen Laurel Hotel, Penang (101 participants).
- 14 October 2009, 1-Day Seminar on “Adopting Eurocodes EC0, EC1 and EC2 in Malaysia” by various presenters at Armada Hotel, PJ (161 participants).
- 20 June 2009, Half-day Awareness Seminar on “Eurocodes - EC0, EC1 and EC2” by Ir MC Hee at UTAR Campus, PJ (101 participants).

Under the SMART Partnership Programme between IEM and Standards Malaysia, some funding was provided by Standards Malaysia to IEM as a grant to promote the usage of MS EN publications since 2012.

In 2014, IEM continued the SMART Partnership Programme with Standards Malaysia in promoting the use of published MS EN standards. A series of awareness seminars were organised and held in Kota Kinabalu (27 October 2014), Miri (29 October 2014), Penang (10 November 2014), Johor Baru (13 November 2014), Kuala Lumpur (2 December 2014) and finally in Kuching (8 December 2014). A total of 231 registered participants had attended the series of one-day seminars held nationwide in the selected venues. These activities will continue in 2015 in other states, whenever possible.

The following are some of the recorded comments by the invited speakers on the awareness and participation of the attendees to the recent seminars organised by IEM:

Speaker, Ir Adjunct Prof MC Hee’s comments in response to questions posed on Eurocode 2 awareness:

Q. What was the most challenging question raised by participants in your presentation - and how did you responded?

A. The participants had raised the question on why Malaysia is adopting Eurocodes and whether it is more cost effective compared to BS codes.

Eurocodes are one the most advanced codes of practice (as performance-based codes) in the world. They are the state-of-the-art codes which allow the design engineers to innovate within the confinement of principle rules which cannot be change and application rules in which design engineers are allowed to alter.

Furthermore, the UK had adopted fully the Structural Eurocodes (to be followed by Singapore in May 2015). All the BS codes are not going to be maintained, hence it is logical for us to follow our UK counterpart in adopting the Eurocodes.

In research carried out on a personal basis, on the cost comparison for design of office buildings using BS8110 and EC2, it was found that, for all practical purposes, there is not much difference in cost between the two designs.

Q. In your opinion, do you think the participants are able to adopt MS EN1992 in place of BS8110 for concrete designs in the short term? Why?

A. The answer is YES. So long as IEM conducts more practical Eurocode courses by engaging practicing consulting engineers such as us, and not academicians. However, the honorariums paid by IEM is much too low to attract practicing consultants to deliver good courses. IEM should review its activity guidelines on honorariums for speakers in their organized events.

Speaker, Ir David Ng had these to say to the same queries but on Eurocode 3:

Q. What was the most challenging query raised by participants in your presentation - and how did you respond?

A. It was quite obvious that the participants were not well-versed in the design of steel structures whether in accordance to Eurocode EC3 or the BS 5950. The timeline for adoption of Eurocode EC3 is still doubtful amongst the participants. There is a question on the specifications of materials for the use of the Eurocode EC3 which needs to be addressed.

Q. In your opinion, do you think the participants are able to adopt MS EN1993 in place of BS5950 for steel designs in the short term? Why?

A. There are two answers to this. For those who are not well-versed in the BS 5950 in steel design, the learning curve to adopt Eurocode EC3 in steel design, is not an issue since they have to start from scratch anyway. And for those who are competent in the use of BS 5950 for steel designs, the adoption efforts should be minimal since both of these codes bear a lot of similarity in their concepts.

The following is a brief outline of the seminar as presented during the awareness campaign:

- Introduction and background to the adoption and implementation of Eurocodes in Malaysia
- Guidelines on the use of MS EN1990 Basis of Structural Design
 - Established the principles and requirements for safety and serviceability.
 - Presented the basis and general principles for the structural design and verification of buildings and civil engineering structures.
 - Provided guidelines for related aspects of structural reliability, durability and quality control, based on the limit state concept and used in conjunction with the partial factor method.
 - Elaborated on the examples of action combinations.
- MS EN 1991-1-1 Actions on Structures – Part 1-1 : General Actions – Densities, Self-weight, Imposed Loads for Buildings covers the assessment of actions for use in structural design due to:
 - the density of construction materials and stored materials;
 - the self-weight of structural elements and whole structures, and some fixed non-structural items;
 - imposed loads on floors and roofs of buildings (but excluding snow, which is covered by BS EN 1991-1-3, *Snow loads*).
- MS EN1992-1-1 Design of Concrete Structures – Part 1-1 : General Rules and Rules for Building Structures gives;
 - a general basis for the design of structures in plain, reinforced and pre-stressed concrete made with normal and light weight aggregates together with specific rules for buildings.
 - the focus on typical structural components, such as design of beams, slabs and columns.
 - examples of lecture materials delivered (see Figures 3 and 4 below):
- MS EN1993-1-1 Design of Steel Structures – Part 1-1 : General Rules and Rules for Building Structures assures the steel designer that;
 - once they become familiar with the appropriate MS EN1993 documents (a significant task, as this includes the many parts of the Eurocodes, the national annexes and other supporting information), and familiar with the layout of the clauses within the Standard, the process will be reassuringly similar to design to BS 5950.
 - the focus was on new terminology and equations found in MS EN1993 compared to the provisions in BS 5950.

Basic span-to-effective-depth ratios

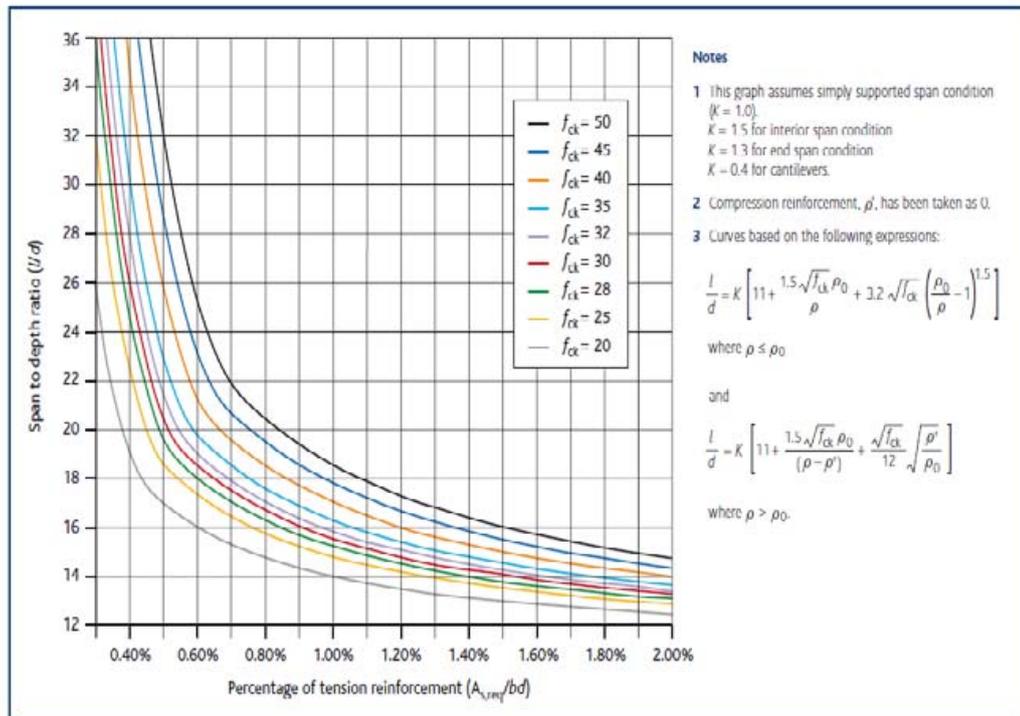


Figure 3 – Design chart for beam span/depth ratio to Eurocode 2

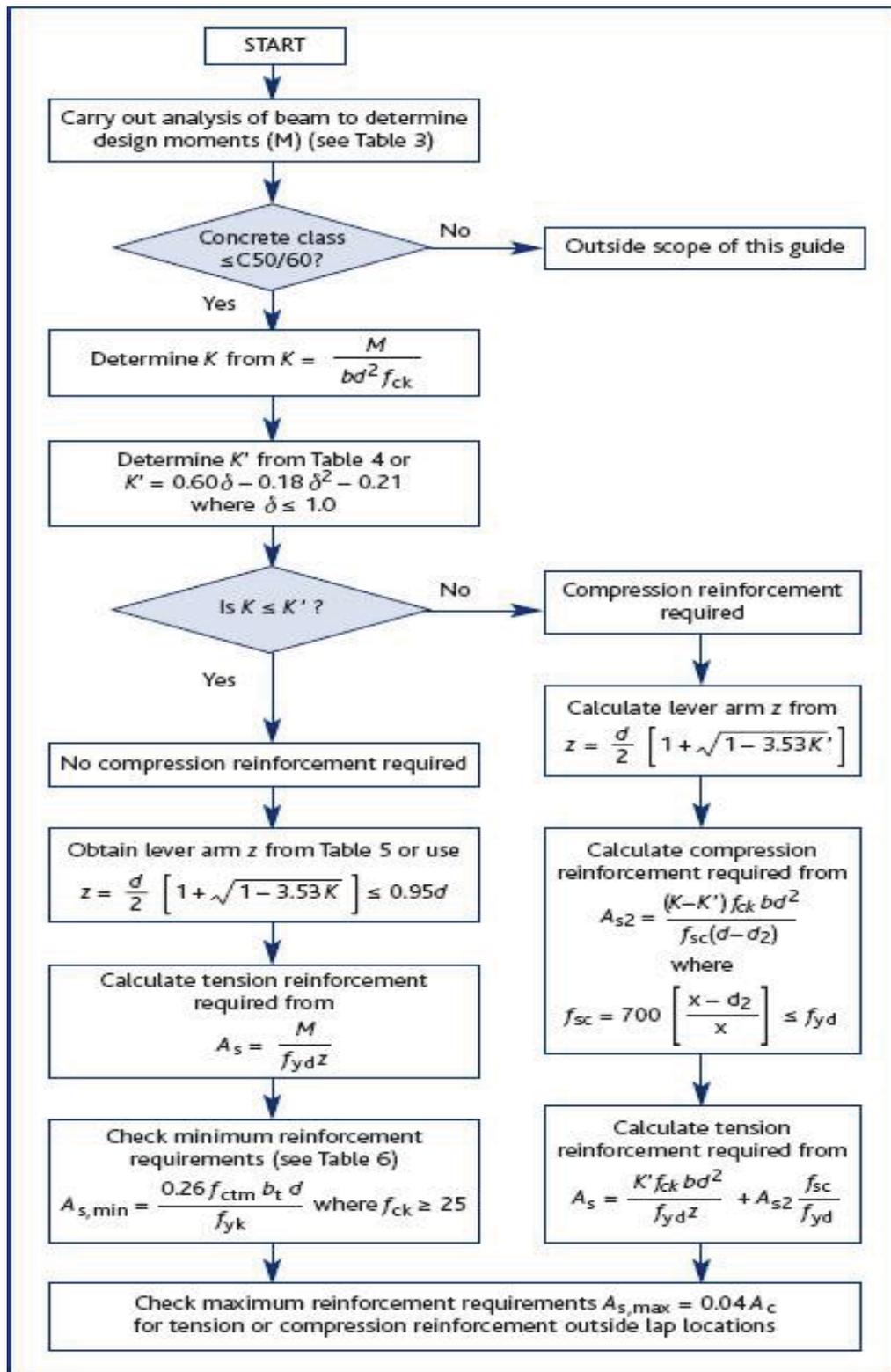


Figure 4 – Flowchart for Flexural Design to Eurocode 2

Figure 3 is a typical design chart developed by the Concrete Centre, the UK, to assist designers in selecting beam configurations for appropriate span/depth ratio, while Figure 4 shows an overall view of the procedures in flexural design of reinforced concrete beams in accordance to Eurocode 2 designs.

IX. USEFUL REFERENCES ON EUROCODES

The following are some useful references solely on Eurocode 2:

- Designers' Guide to Eurocode 0: Basis of Structural Design, 2nd Edition (Designers Guides to the Eurocodes), by Haig Gulvanessian et. al., indicative price at USD121.34.
- Designers' Guide to EN 1992-1-1 and EN 1992-1-2: Design of Concrete Structures. General rules and rules for buildings and structural fire design (Designers Guides to the Eurocodes), by R.S. Narayanan et al, indicative price at USD105.37.
- Manual for Detailing Reinforced Concrete Structures to EC2, by Jose Calavera, indicative price at USD114.51.
- Worked Examples for the Design of Concrete Structures to Eurocode 2, by Tony Threlfall, indicative price at USD48.12.
- Reinforced Concrete Design: To Eurocode 2, by W.H.Mosley & R.Hulse, indicative price at USD47.07.
- Concise Eurocode 2, published by The Concrete Centre, UK, priced at GBP45.
- How to Design Concrete Structures to Eurocode 2 – A Compendium, published by The Concrete Centre, UK, priced at GBP45.
- Properties of Concrete for use in Eurocode 2, published by The Concrete Centre, UK, priced at GBP45.
- Worked Examples to Eurocode 2: Volume 1, published by The Concrete Centre, UK, priced at GBP45.

X. PROPOSED HIERARCHY OF STANDARDS ADOPTION

It has to be noted that there are a total of 58 Parts of Eurocodes to be drafted in terms of National Annex before being adopted as such into NA to MS ENxxxx. So far, IEM has assisted Standards Malaysia in developing 10 sets or parts of the Eurocodes, which are deemed to be essential for initial use in the industry.

Hence, in terms of the hierarchy of standards to be adopted, in accordance to the Uniform Building By Laws (UBBL), the Malaysian Standards, should they be available, shall take precedence over all the other referenced standards, even the British Standards.

It has to be noted that there is a Malaysian Standards on Design of Concrete Structures, MS1195-1997 which is the replica of BS8110, but in the professional practices, all references are still made to BS8110 and other BS codes.

Nevertheless, with the revised UBBL 2012, the Malaysian Standards in the form of MS EN199x – 2010 shall take precedence when they have been developed and published.

But in the case of the Eurocode parts yet to be developed into NA to MS EN versions, it was decided that the British equivalents, NA to BS EN versions shall prevail. In the event of situations where neither MS EN nor BS EN could provide guidance, then the original EN standards shall be referred to.

Under very special circumstances, especially in specialists' areas not covered by the preceding standards, the users may refer to other accepted international standards available such as ISO, ACI, AS, NZS, CNS, and so forth. This is up to the discretion of the design engineers, who shall take full responsibility based on their knowledge and experience.

XI. FURTHER WORKS IN COMPLETING MS EN1992 EUROCODE 2 AND MS EN1993 EUROCODE 3 AND OTHER MS EN EUROCODES IN PROGRESS

So far, IEM has completed only Part 1-1 in both MS EN1992 and MS EN1993, and there are three more parts that precede in Eurocode 2 alone, as shown below for the equivalent BS EN versions:

- BS EN 1992-1-2:2004 Eurocode 2 Design of concrete structures: General rules: Structural fire design.
- BS EN 1992-2:2005 Eurocode 2 Design of concrete structures: Concrete bridges: Design and detailing rules.
- BS EN 1992-3:2006 Eurocode 2 Design of concrete structures: Liquid retaining and containing structures.

In the immediate future, IEM is planning to organize two Technical Committees to draft MS EN1992-1-2 (Structural fire design) and MS EN1992-2 (Concrete bridges design and detailing rules). There is no decision yet on the next part(s) to be tackled by the Eurocode 3 Technical Committee on Steel Design.

Two MS EN standards are about to be completed soon by IEM, likely in 2015. They are for earthquake designs and structural steel joints, and are based on the following BS EN equivalents:

- BS EN 1998-1:2004 Eurocode 8 Design of structures for earthquake resistance: General rules, seismic actions and rules for buildings.
- BS EN 1993-1-8:2005 Eurocode 3 Design of steel structures: Design of joints.

Another MS EN standard on wind load design for buildings, which is still very much in progress and is based on the following BS EN equivalent:

- BS EN 1991-1-4:2005 Eurocode 1 Actions on structures: General actions: Wind actions.

XII. CONCLUSION

The IEM Position Paper was published in 2004 which specified the need to adopt Eurocode EC2 (or to be more precise EN1992:2002) as the basis to draft the Malaysian Standards National Annex, for design of concrete structures.

Since then, two Technical Committees were formed to draft the MS EN standards for concrete design and steel design, together with the basis of structural design and actions on structures. MS EN standard on geotechnical designs was completed by a Working Group led by IEM, under the purview of another Technical Committee.

The three engineering bodies, BEM, IEM and ACEM have proposed a transition period to implement the adoption of Eurocodes, but this was not accepted by the Ministry of Housing and Local Government.

The intention was to institute a 3-year transition period – during which both MS EN standards and BS codes can co-exist and be used as submission standards. The proposed start of the transition was supposed to be from 1 June 2014 till 31 May 2017.

The Institution of Engineers Malaysia, through the Civil & Structural Engineering Technical Division has been actively organizing many awareness seminars and courses since 2009 on Eurocodes especially on Eurocode 2 (Concrete Design) and Eurocode 3 (Steel Design). These activities will continue intensively in 2015, in collaboration with Standards Malaysia.

All the measures to enable a smooth transition to MS EN standards have to be implemented so that practicing structural engineers can work within the required safety and economical needs of built concrete structures.

There is still much work ahead to complete the tasks in developing all the remaining parts of MS EN standards, and this can be done if co-operation and understanding can be sought from all relevant stakeholders in the construction industry.

XIII. ACKNOWLEDGMENTS

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