Technical References on Steel Reinforcement *

1. **Safe & Economical use of Class L mesh in Suspended Concrete Floors**
   Dr Mark Patrick
   ACEA NSW Seminar, April 2007
   This paper sets out the rationale to confirm that Class L mesh is a reliable, fit-for-purpose product that can be used in suspended concrete floors designed in accordance with AS3600.

2. **Safe Design of Slabs and Beams incorporating Class L Mesh**
   Dr. Mark Patrick
   SRIA Technical Paper – November 2005.
   This paper provides structural engineers with the latest advice about using the recently amended Concrete Structures Standard, AS3600-2001, which contains some new rules for the safe design of conventional concrete slabs and beams incorporating 500 MPa Class L mesh as the main reinforcement.
   Published in Concrete Australia, Dec.2005, pages 23-27.

3. **Important New Developments in Composite Beam Shear Connection Design and Detailing for Trapezoidal Steel Decking**
   Mark Patrick, Ross Grey, Winston Marsden.
   22nd Biennial Conference, Concrete 05, Oct. 2005.
   A number of highly innovative wire reinforcing components have been developed in Australia to significantly improve the structural performance and detailing practices of shear connection between steel beams and composite slabs incorporating welded studs.

4. **Innovative Testing Procedures for a High-Performance, Pre-formed Mechanical Connection System between Concrete Slabs and Walls**
   Mark Patrick, Andrew Wheeler, Armando Gonzales, Winston Marsden..
   22nd Biennial Conference, Concrete 05, Oct. 2005.
   The results of two innovative full-scale tests on slab-to-wall connections Incorporating a high-performance, pre-formed mechanical connection system are presented.

5. **Load Transfer Capacity of Contraction Joints in Reinforced-Concrete Pavements.**
   Mark Patrick, Winston Marsden, Ross Grey,
   22nd Biennial Conference, Concrete 05, Oct. 2005.
   A purpose built rig was used to test the load transfer capacity of three types of contraction joints in concrete pavements. Both plain concrete and polypropylene fibre reinforced concrete were tested.

6. **Ultra Long-Spanning Hybrid Composite Flooring System –Technical Developments.**
Mark Patrick, Ross Grey, Con Komselis.
22nd Biennial Conference, Concrete 05, Oct 2005.
An ultra Long-spanning, permanent, combined steel formwork and reinforcing system has been developed in Australia. Aspects of technical development are presented.

7. **Ultra Long-Spanning Hybrid Composite Flooring System – Design and Construction Case Studies.**
Mark Patrick, Ross Grey, Con Komselis.
22nd Biennial Conference, Concrete 05, Oct 2005.
An ultra Long-spanning, permanent, combined steel formwork and reinforcing system has been developed in Australia. Examples of design and experience gained in Australia are described by way of case studies.

8. **Long-Term Quality of Steel Reinforcement and Strand - Implications for Concrete Design.**
John Fenwick, Ross Pritchard, Mark Turner
22nd Biennial Conference, Concrete 2005, Oct 2005
Long term quality data for reinforcement was presented. Data collected from strand testing was also presented. This information can be used by designers and specifiers

9. **Behaviour of One-Way Continuous Reinforced Concrete Slabs, Constructed with Grade 500 Class L mesh Steel, under Support Settlement.**
U. Siddique, H. Goldsworthy, R. Gravina.
22ND Biennial Conference, Concrete 2005, Oct 2005.
An experimental test program was undertaken to study the ductility of continuous slabs that were subjected to support settlement and reinforced with Class L mesh.

10. **Important New Code Developments for Designing Reinforced Concrete Continuous Beams, and One- way and Two-way Slabs Incorporating Class L and Class N Main Reinforcement.**
ASEC Conference, Sept 2005.
M. Patrick, A. Wheeler, M.Turner, W. Marsden, P.Sanders
The paper discusses the rule amendments to AS3600 in relation to the design of beams and slabs using simplified design methods.

11. **Development and Application of Innovative Composite Beam Shear Connection Enhancements for Australian Construction.**
M. Patrick, R. Grey, W. Marsden
ASEC Conference, Sept 2005.
A number of highly innovative wire reinforcing components have been developed in Australia to improve the structural performance and detailing practices of shear connection between steel beams and composite slabs incorporating welded studs.

12. **Ultra Long-spanning Hybrid Composite Flooring System.**
C. Komselis, R.Grey, A.Griffiths, M. Patrick.
ASEC Conference, Sept 2005.
An ultra long-spanning, permanent, combined steel formwork and reinforcing system has been developed in Australia. Some of the major details of the system are described in the paper.

13. **Effect of Bending on the Strength and Ductility of Bar Reinforcement**
A.Wheeler, M. Patrick, R. Bridge, W. Marsden.
CONCRETE 2003 Conference. Brisbane. July 2003.
This paper reports on the testing of reinforcing bars with standard hooks to determine the effect of bend radius on the strength and ductility on the bar. Parameter variables include steel type, bar diameter and internal bend radius. The results of pullout tests showed that the cold bending did not reduce the properties of the bar within the limits of bend radii tested.

14. **Important New Design Provisions for Mechanical and Welded Splices in AS3600.**
Patrick, P. Berry, L. Zhang, W. Marsden
CONCRETE 2003 Conference, Brisbane. July 2003.
The behaviour exhibited by different types of reinforcement splices is discussed. The splicing techniques included mechanical couplings and welded connections. The performance of all the common types of splices in regard to strength, ductility and slip together with overseas design code requirements are reviewed.

15. **Innovative Applications of Australian Reinforcing Steel in Composite Beam Shear Connection.**
Patrick, R. Bridge, R. Grey, W. Marsden.
CONCRETE 2003 Conference, Brisbane. July 2003.
This paper outlined new and innovative types of reinforcement that were developed to overcome critical shear failure modes in concrete around stud connections of composite beams that incorporated profiled steel sheeting.

16. **Ductility of Reinforced Concrete Flexural Members with 500 MPa**
R. Gravina
CONCRETE 2003 Conference, Brisbane. July 2003.

17. **Systemic Improvements to Structural Steel Decking**
Patrick, R. Grey
Advances in Structures, ASSCCA'03, June 2003

18. **Effects of High Strength Concrete and Reinforcement on Column Slenderness.**
Wheeler, R. Bridge, W. Marsden.
Advances in Structures, ASSCCA'03. June 2003.

19. Design of Concrete Columns to AS 3600-2001.
A.Wheeler and R.Bridge.
CONCRETE 2001 Conference, Perth, September 2001
This paper outlines the new rules for 500 grade reinforcing steels and shows that designers can obtain benefits when utilising the stronger steels in columns. Significant savings in steel reinforcement can be achieved leading to more economical design solutions.

20. Utilisation of ductility of 500 MPa steel reinforcement in reinforced-concrete structures designed to AS 3600-2001.
M.Patrick, M.Turner and R.Warner.
CONCRETE 2001 Conference, Perth, September 2001
The research findings of this paper show that the new design rules for 500 grade reinforcing steels can be used with confidence. The rules provide guidance for both ductility classes of steel as well as advice and restrictions on Class L steels.

21. New crack control provisions in AS 3600-2001.
A.Wheeler, M.Patrick and R.Bridge.
CONCRETE 2001 Conference, Perth, September 2001
The new design provisions in AS 3600-2001 to control cracking in beams and slabs are reviewed and explained in this paper. Worked examples are presented using computer software that incorporates a new design approach that enables designers to effectively use the new 500 grade steels and achieve an efficient design.

22. Strength and ductility of mechanical spliced bars.
M.Patrick, P.Berry and R.Bridge
CONCRETE 2001 Conference, Perth, September 2001
With the move to 500 grade reinforcing steels in Australia, the demand on bar couplings has been increased. This paper outlines the design principles and provides a design model for splices. It proposes that where couplings are used in critical regions, the splice should achieve at least the minimum ductility requirements for Class N steel as specified in AS 3600-2001.

23. Experimental investigation into the behaviour of slabs with continuous plastic bar chairs
M.Patrick, R.Bridge, P.Berry and R.Grey.
CONCRETE 2001 Conference, Perth, September 2001
Continuous plastic bars chairs have been introduced into Australia to provide a simple means of bar support for bar reinforcement and in particular for use with the reinforcement carpet system, BAMTEC. The results as presented in this paper show that the continuous plastic chairs do not effect the cracking and strength of a slab when placed in a critical compression zone of the slab.

24. Novel new reinforcing components for composite beams.
M.Patrick, R.Bridge and W.Marsden
CONCRETE 2001 Conference, Perth, September 2001
This paper outlines the development of three novel reinforcing components that provide a simple and effective solution to the shear stresses acting in the vicinity of slab and beam connections in composite slabs. Standard products (DECKMESH and STUDMESH) have been developed that can be readily specified by engineers to solve design problems.

25. Factors Affecting the Ductility of Stiffened Rafts.

Adams, P. Walsh, W. Marsden.
CONCRETE 99 Conference, Concrete Institute of Australia. May, 1999.

26. **Evaluation of Crack Control Design Rules for Reinforced Concrete Beams and Slabs.**
Gilbert, M. Patrick, J. Adams.
CONCRETE 99 Conference, Concrete Institute of Australia. May, 1999.

27. **Ductility of Reinforced-Concrete Beams and Slabs, and AS 3600 Design Requirements.**
Chick, M. Patrick, K. Wong.
CONCRETE 99 Conference, Concrete Institute of Australia. May, 1999.

28. **Australian 500 MPa Reinforcing Steels and New AS 3600 Ductility Design Provisions.**
Patrick
Seminar Proceedings: AS 3600 Amendment 2 (1999).
Concrete Institute of Australia. April, 1999

29. **Design of continuous composite beams for bending strength.**
Patrick & D. Dayawansa.
ASEC Conference- Auckland. Sept.-Oct, 1998.

30. **Deflection calculation and control for reinforced concrete structures.**
Gilbert.
ASEC Conference - Auckland. Sept.-Oct, 1998.

31. **Performance-based fire design for Australian reinforced concrete structures.**
Sanders
ASEC Conference - Auckland. Sept.-Oct, 1998.

32. **Non-Linear, Overload Behaviour of Reinforced Concrete Structures.**
Gravina.
Dept. of Civil & Environ. Eng. University of Adelaide. July, 1998.

33. **Design of Composite Slabs for Strength, Design Booklet DB3.1.**
BHP Structural Steel Composite Structures Design Manual.
BHP Integrated Steel. May, 1998.

34. **Ductility in reinforced concrete: Why is it needed and how is it achieved?**
Beeby.
The Structural Engineer, 76(9), pp.180-183, May, 1998.

35. **High Strength, Weldable Reinforcing Bars.**
Russwurm & P. Wille.
Micro-alloying '95 Conference. Germany, 1998.

36. **Simplified Design of Continuous Composite Slabs including Moment Redistribution and Crack Control.**
Proe, M. Patrick, C.C. Goh.
Proc. 15th Australasian Conference on the Mechanics of Structures and

Materials. Melbourne. December, 1997.

37. Use of High-Strength Reinforcement in Concrete Structures - Design Implications.
Patrick
Seminar Proceedings: The Use of High Strength Concrete and High Strength Reinforcement in Concrete Structures.
The Munro Centre, University of New South Wales. Nov.1997.

38. Reinforcing Against Longitudinal Shear Failure of Composite Edge Beams.
M. Patrick, R Grey, W. Marsden.
Concrete '97 - 18th Biennial Conference. Adelaide. May, 1997.

39. Ductility Limits for the Design of Concrete Structures containing High-Strength, Low Elongation Steel Reinforcement.
Patrick, E. Akbarshahi, R.F. Warner.
Concrete '97 - 18th Biennial Conference. Adelaide. May, 1997.

40. Computer Simulation Study of Continuous Flexural Members containing High-Strength, Low-Elongation Steels, Supplementary Report to BHP Research.
Akbarshahi.
Dept. Civil & Environmental Engineering
University of Adelaide. May, 1997.

41. Polypropylene Fibres in Hardened Concrete.
I.Boxall.
Fibres in Concrete 97 Seminar. Cement and Concrete Assoc. April, 1997.

42. Ductility Limits for the Design of Concrete Structures Containing High-Strength, Low-Elongation Steel Reinforcement.
Patrick, E. Akbarshahi, R.F.Warner.
Proc. Concrete '97, Concrete Institute of Australia. 1997.

43. Design of Residential Slabs and Industrial Pavements, and the Use of Polypropylene Fibres.
Proe, B.L. Schafer, M. Patrick.
Proc. Concrete '97. Concrete Institute of Australia. 1997, pp. 509-517.

44. Development Lengths of Reinforcement in High-strength Concrete
Mendis P, French C.
Australian Civil/Structural Engineering Transactions.
Vol CE39. No.1, 1997.

45. AS 3600 and the Move to 500 MPa Reinforcing Steels.
Patrick
Concrete Institute Of Australia. Seminar notes. July, 1996.

46. The Engineering Design Of Tilt-Up Systems.
Truswell.
Tilt Up Seminar; C & C A - Sydney. March, 1996.

47. Ductility of Reinforced Concrete Members.
Beeby.
University of Leeds. 1996.

48. Ductility Requirements for Reinforcement under Eurocodes.
G.Macchi, P.E.Pinto, L.Sanpaolesi.
Structural Engineering International, 4/96. pp. 249 - 254. 1996

49. Designers' Handbook to Eurocode 2, Part 1.1: Design of Concrete Structures
Beeby & R.S. Narayanan.
Thomas Telford, London. 1995.

50. Concrete Structures Euro-Design Handbook Part C: Design of Concrete Structures to ENV 1992 – Eurocode 2.
Litzner.
Ernst & Sohn, pp.137 to 308. 1994

51. Steel for the Reinforcement of Concrete; Weldable Ribbed Reinforcing Steel Grade B500; Technical Delivery Conditions for Bars, Coils and Welded Fabric, Final Draft, ENV 10080.
European Committee for Standardization CEN. Brussels. 1994.

52. Rotation Capacity of Plastic Hinges and Allowable Moment Redistribution
R. Eligehausen & P. Langer.
Comite Euro-International du Beton. Lausanne, 1987.

53. Maximum Crack Width in Reinforced Concrete Flexural Members.
Gergely, L.A. Lutz.
ACI SP-20. pp. 87-117. Detroit, 1