CONSTRUCTION TECHNOLOGY

Edited by
Paul S. Chinowsky

CRITICAL CONCEPTS IN CONSTRUCTION

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Critical Concepts in Construction

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Chronological table of reprinted articles and chapters

Date	*Author*	*Title*	*Source*	*Vol.*	*Chap.*
1984	Zohar Herbsman and J. D. Mitrani	INES—An interactive estimating system	*Journal of Construction Engineering and Management*, 110:1, 19–33.	I	1
1985	Task Committee on Application of Small Computers in Construction of the Construction Division	Application of small computers in construction	*Journal of Construction Engineering and Management*, 111:3, 173–89.	I	2
1985	A. Warszawski	Decision models and expert systems in construction management	*Building and Environment*, 20:4, 201–10.	IV	73
1986	C. William Ibbs	Future directions for computerized construction research	*Journal of Construction Engineering and Management*, 112:3, 326–45.	I	3
1987	Chris Hendrickson, Carlos Zozaya-Gorostiza, Daniel Rehak, Eduardo Barocco-Miller and Peter Lim	Expert system for construction planning	*Journal of Computing in Civil Engineering*, 1:4, 253–69.	IV	74
1987	James T. O'Connor, Stephen E. Rusch and Martin J. Schulz	Constructability concepts for engineering and procurement	*Journal of Construction Engineering and Management*, 113:2, 235–48.	II	29
1988	Lansford C. Bell and Bob G. McCullouch	Bar code applications in construction	*Journal of Construction Engineering and Management*, 114:2, 263–78.	I	4
1989	B.-C. Bjork	Basic structure of a proposed building product model	*Computer-Aided Design*, 21:2, 71–8.	III	56
1989	H. C. Howard, R. E. Levitt, B. C. Paulson, J. G. Pohl and C. B. Tatum	Computer integration: reducing fragmentation in AEC industry	*Journal of Computing in Civil Engineering*, 3:1, 18–32.	III	50
1989	Roozbeh Kangari and Leland S. Riggs	Construction risk assessment by linguistics	*IEEE Transactions on Engineering Management*, 36:2, 126–31.	II	44

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Date	*Author*	*Title*	*Source*	*Vol.*	*Chap.*
1990	Simaan M. AbouRizk and Daniel W. Halpin	Probabilistic simulation studies for repetitive construction processes	*Journal of Construction Engineering and Management*, 116:4, 575–94.	II	25
1990	Leonhard E. Bernold, Dulcy M. Abraham and Davis B. Reinhart	FMS approach to construction automation	*Journal of Aerospace Engineering*, 3:2, 108–21.	II	42
1990	S. J. Fenves, U. Flemming, C. Hendrickson, M. L. Maher and G. Schmitt	Integrated software environment for building design and construction	*Computer-Aided Design*, 22:1, 27–36.	I	5
1990	Satish Mohan	Expert systems applications in construction management and engineering	*Journal of Construction Engineering and Management*, 116:1, 87–99.	IV	75
1990	Victor E. Sanvido and Deborah J. Medeiros	Applying computer-integrated manufacturing concepts to construction	*Journal of Construction Engineering and Management*, 116:2, 365–79.	II	40
1990	Mirosław J. Skibniewski and Chris Hendrickson	Automation and robotics for road construction and maintenance	*Journal of Transportation Engineering*, 116:3, 261–71.	II	41
1991	Jonathan Cherneff, Robert Logcher and D. Sriram	Integrating CAD with construction-schedule generation	*Journal of Computing in Civil Engineering*, 5:1, 64–84.	IV	76
1991	Deborah J. Fisher and James T. O'Connor	Constructability for piping automation: field operations	*Journal of Construction Engineering and Management*, 117:3, 468–85.	II	30
1991	I. D. Tommelein, R. E. Levitt, B. Hayes-Roth and T. Confrey	SightPlan experiments: alternate strategies for site layout design	*Journal of Computing in Civil Engineering*, 5:1, 42–63.	IV	77
1993	Ali Touran	Probabilistic cost estimating with subjective correlations	*Journal of Construction Engineering and Management*, 119:1, 58–71.	I	13
1993	A. Wong and D. Sriram	SHARED: an information model for cooperative product development	*Research in Engineering Design*, 5:1, 21–39.	III	57

1994	Paul Teicholz and Martin Fischer	Strategy for computer integrated construction technology	*Journal of Construction Engineering and Management*, 120:1, 117–31.	III	51
1994	Richard L. Tucker, James T. O'Connor, Thomas M. Gatton, G. Edward Gibson, Jr., Carl T. Haas and David N. Hudson	The impact of computer technology on construction's future	*Microcomputers in Civil Engineering*, 9:1, 3–11.	I	6
1994	Trefor P. Williams	Predicting changes in construction cost indexes using neural networks	*Journal of Construction Engineering and Management*, 120:2, 306–20.	I	14
1995	Irtishad U. Ahmad, Jeffrey S. Russell and Azza Abou-Zeid	Information technology (IT) and integration in the construction industry	*Construction Management and Economics*, 13:2, 163–71.	III	52
1996	Weng-Tat Chan, David K. H. Chua and Govindan Kannan	Construction resource scheduling with genetic algorithms	*Journal of Construction Engineering and Management*, 122:2, 125–32.	I	7
1996	M. Y. Cheng and J. T. O'Connor	ArcSite: enhanced GIS for construction site layout	*Journal of Construction Engineering and Management*, 122:4, 329–36.	IV	78
1996	Thomas Froese	Models of construction process information	*Journal of Computing in Civil Engineering*, 10:3, 183–93.	III	58
1996	Yan Jin and Raymond E. Levitt	The virtual design team: a computational model of project organizations	*Computational & Mathematical Organization Theory*, 2:3, 171–95.	IV	89
1996	Pasit Lorterapong and Osama Moselhi	Project-network analysis using fuzzy sets theory	*Journal of Construction Engineering and Management*, 122:4, 308–18.	I	8
1997	Martin Fischer and C. B. Tatum	Characteristics of design-relevant constructability knowledge	*Journal of Construction Engineering and Management*, 123:3, 253–60.	II	31
1997	Mirosław J. Skibniewski, Tomasz Arciszewski and Kamolwan Lueprasert	Constructability analysis: machine learning approach	*Journal of Computing in Civil Engineering*, 11:1, 8–16.	II	32
1998	Nashwan Dawood	Estimating project and activity duration: a risk management approach using network analysis	*Construction Management and Economics*, 16:1, 41–8.	II	45

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1998	Gijsbertus T. Luiten, Frits P. Tolman and Martin A. Fischer	Project-modelling in AEC to integrate design and construction	*Computers in Industry*, 35:1, 13–29.	III	53
1999	Tarek Hegazy	Optimization of resource allocation and leveling using genetic algorithms	*Journal of Construction Engineering and Management*, 125:3, 167–75.	I	9
1999	Raymond E. Levitt, Jan Thomsen, Tore R. Christiansen, John C. Kunz, Yan Jim and Clifford Nass	Simulating project work processes and organizations: toward a micro-contingency theory of organizational design	*Management Science*, 45:11, 1479–95.	IV	90
1999	Julio C. Martinez and Photios G. Ioannou	General-purpose systems for effective construction simulation	*Journal of Construction Engineering and Management*, 125:4, 265–76.	II	26
1999	E. Sarah Slaughter	Assessment of construction processes and innovations through simulation	*Construction Management and Economics*, 17:3, 341–50.	II	36
1999	Frits P. Tolman	Product modeling standards for the building and construction industry: past, present and future	*Automation in Construction*, 8:3, 227–35.	III	59
2000	E. Gambao, C. Balaguer and F. Gebhart	Robot assembly system for computer-integrated construction	*Automation in Construction*, 9:5–6, 479–87.	II	43
2000	Makarand Hastak and Aury Shaked	ICRAM-1: model for international construction risk assessment	*Journal of Management in Engineering*, 16:1, 59–69.	II	47
2000	Bonsang Koo and Martin Fischer	Feasibility study of 4D CAD in commercial construction	*Journal of Construction Engineering and Management*, 126:4, 251–60.	III	63
2000	J. H. M. Tah and V. Carr	A proposal for construction project risk assessment using fuzzy logic	*Construction Management and Economics*, 18:4, 491–500.	II	46

2000	J. Whyte, N. Bouchlaghem, A. Thorpe and R. McCaffer	From CAD to virtual reality: modelling approaches, data exchange and interactive 3D building design tools	*Automation in Construction*, 10:1, 43–55.	III	64
2001	Vineet R. Kamat and Julio C. Martinez	Visualizing simulated construction operations in 3D	*Journal of Computing in Civil Engineering*, 15:4, 329–37.	III	65
2001	Žiga Turk	Phenomenological foundations of conceptual product modellling in architecture, engineering and construction	*Artificial Intelligence in Engineering*, 15:2, 83–92.	III	60
2002	M. Alshawi and I. Faraj	Integrated construction environments: technology and implementation	*Construction Innovation*, 2:1, 33–51.	III	54
2002	C. J. Anumba and K. Ruikar	Electronic commerce in construction: trends and prospects	*Automation in Construction*, 11:3, 265–75.	I	22
2002	David Arditi, Ahmed Elhassan and Y. Cengiz Toklu	Constructability analysis in the design firm	*Journal of Construction Engineering and Management*, 128:2, 117–26.	II	33
2002	P. E. D. Love, G. D. Holt, L. Y. Shen, H. Li and Z. Irani	Using systems dynamics to better understand change and rework in construction project management systems	*International Journal of Project Management*, 20:6, 425–36.	I	10
2002	Michael J. Mawdesley, Saad H. Al-Jibouri and Hongbo Yang	Genetic algorithms for construction site layout in project planning	*Journal of Construction Engineering and Management*, 128:5, 418–26.	IV	80
2003	Mustafa Alshawi and Bingunath Ingirige	Web-enabled project management: an emerging paradigm in construction	*Automation in Construction*, 12:4, 349–64.	I	23
2003	Daniel Baloi and Andrew D. F. Price	Modelling global risk factors affecting construction cost performance	*International Journal of Project Management*, 21:4, 261–9.	II	48
2003	Paul S. Chinowsky and Eddy M. Rojas	Virtual teams: guide to successful implementation	*Journal of Management in Engineering*, 19:3, 98–106.	IV	84
2003	Ming Lu	Simplified discrete-event simulation approach for construction simulation	*Journal of Construction Engineering and Management*, 129:5, 537–46.	II	27

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2003	Sheryl Staub-French, Martin Fischer, John Kunz, Kos Ishii and Boyd Paulson	A feature ontology to support construction cost estimating	*Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, 17:2, 133–54.	I	15
2004	D. Bouchlaghem, A. G. Kimmance and C. J. Anumba	Integrating product and process information in the construction sector	*Industrial Management and Data Systems*, 104:3, 218–33.	III	62
2004	Emad Elbeltagi, Tarek Hegazy and Adel Eldosouky	Dynamic layout of construction temporary facilities considering safety	*Journal of Construction Engineering and Management*, 130:4, 534–41.	IV	79
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2004	Gwang-Hee Kim, Sung-Hoon An and Kyung-In Kang	Comparison of construction cost estimating models based on regression analysis, neural networks, and case-based reasoning	*Building and Environment*, 39:10, 1235–42.	I	16
2004	Pollaphat Nitithamyong and Mirosław J. Skibniewski	Web-based construction project management systems: how to make them successful?	*Automation in Construction*, 13:4, 491–506.	I	24
2004	Ma Zhiliang, Li Heng, Q. P. Shen and Yang Jun	Using XML to support information exchange in construction projects	*Automation in Construction*, 13:5, 629–37.	III	61
2005	Tamaki Horii, Yan Jin and Raymond E. Levitt	Modeling and analyzing cultural influences on project team performance	*Computational & Mathematical Organization Theory*, 10:4, 305–21.	IV	91
2005	Michael H. Pulaski and Michael J. Horman	Organizing constructability knowledge for design	*Journal of Construction Engineering and Management*, 131:8, 911–19.	II	34
2006	Patricia Carrillo and Paul Chinowsky	Exploiting knowledge management: the engineering and construction perspective	*Journal of Management in Engineering*, 22:1, 2–10.	IV	82

2006	Patrick Sik-wah Fong and Lily Chu	Exploratory study of knowledge sharing in contracting companies: a sociotechnical perspective	*Journal of Construction Engineering and Management*, 132:9, 928–39.	IV	81
2007	Amjad El-Tayeh and Nuno Gil	Using digital socialization to support geographically dispersed AEC project teams	*Journal of Construction Engineering and Management*, 133:6, 462–73.	IV	85
2007	Timo Hartmann and Martin Fischer	Supporting the constructability review with 3D/4D models	*Building Research & Information*, 35:1, 70–80.	II	35
2007	Julian H. Kang, Stuart D. Anderson and Mark J. Clayton	Empirical study on the merit of web-based 4D visualization in collaborative construction planning and scheduling	*Journal of Construction Engineering and Management*, 133:6, 447–61.	III	67
2009	David Arditi and Ranon Chotibhongs	Detection and prevention of unbalanced bids	*Construction Management and Economics*, 27:8, 721–32.	I	17
2009	R. Sacks, O. Rozenfeld and Y. Rosenfeld	Spatial and temporal exposure to safety hazards in construction	*Journal of Construction Engineering and Management*, 135:8, 726–36.	I	18
2009	John E. Taylor and Phillip G. Bernstein	Paradigm trajectories of building information modeling practice in project networks	*Journal of Management in Engineering*, 25:2, 69–76.	III	69
2009	Matt Watkins, Amian Mukherjee, Nilufer Onder and Kris Mattila	Using agent-based modeling to study construction labor productivity as an emergent property of individual and crew interactions	*Journal of Construction Engineering and Management*, 135:7, 657–67.	II	38
2009	Dong Zhai, Paul M. Goodrum, Carl T. Haas and Carlos H. Caldas	Relationship between the automation and integration of construction information systems and labor productivity	*Journal of Construction Engineering and Management*, 135:8, 746–53.	II	37
2010	Symeon Christodoulou	Scheduling resource-constrained projects with ant colony optimization artificial agents	*Journal of Computing in Civil Engineering*, 24:1, 45–55.	I	11
2010	Carrie S. Dossick and Gina Neff	Organizational divisions in BIM-enabled commercial construction	*Journal of Construction Engineering and Management*, 136:4, 459–67.	III	70

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2010	Thomas M. Froese	The impact of emerging information technology on project management for construction	*Automation in Construction*, 19:5, 531–8.	III	55
2010	Ning Gu and Kerry London	Understanding and facilitating BIM adoption in the AEC industry	*Automation in Construction*, 19:8, 988–99.	III	71
2010	Nakhon Kokkaew and Nicola Chiara	Modelling completion risk using stochastic critical path-envelope method: a BOT highway project application	*Construction Management and Economics*, 28:12, 1239–54.	II	49
2010	Gina Neff, Brittany Fiore-Silfvast and Carrie Sturts Dossick	A case study of the failure of digital communication to cross knowledge boundaries in virtual construction	*Information, Communication and Society*, 13:4, 556–73.	IV	86
2011	S. AbouRizk, D. Halpin, Y. Mohamed and U. Hermann	Research in modeling and simulation for improving construction engineering operations	*Journal of Construction Engineering and Management*, 137:10, 843–52.	II	28
2011	Amy Javernick-Will	Knowledge-sharing connections across geographical boundaries in global intra-firm networks	*Engineering Project Organization Journal*, 1:4, 239–53.	IV	83
2011	Weisheng Lu, George Q. Huang and Heng Li	Scenarios for applying RFID technology in construction project management	*Automation in Construction*, 20:2, 101–6.	III	72
2011	Shobha Ramalingam and Ashwin Mahalingam	Enabling conditions for the emergence and effective performance of technical and cultural boundary spanners in global virtual teams	*Engineering Project Organization Journal*, 1:2, 121–41.	IV	87
2011	JeongWook Son and Eddy M. Rojas	Evolution of collaboration in temporary project teams: an agent-based modeling and simulation approach	*Journal of Construction Engineering and Management*, 137:8, 619–28.	IV	92

2012	Paul Chinowsky and John E. Taylor	Networks in engineering: an emerging approach to project organization studies	*Engineering Project Organization Journal*, 2:1–2, 15–26.	IV	93
2012	Behzad Esmaeili and Matthew Hallowell	Integration of safety risk data with highway construction schedules	*Construction Management and Economics*, (ahead-of-print): 1–14.	I	20
2012	John Iorio, John E. Taylor and Carrie Sturts Dossick	A bridge too far: examining the impact of facilitators on information transfer in global virtual project networks	*Engineering Project Organization Journal*, 2:4, 188–201.	IV	88
2012	Wei Zhou, Jennifer Whyte and Rafael Sacks	Construction safety and digital design: a review	*Automation in Construction*, 22: 102–11.	I	19
2013	S. Isaac and R. Navon	A graph-based model for the identification of the impact of design changes	*Automation in Construction*, 31: 31–40.	I	12
2013	Jürgen Melzner, Sijie Zhang, Jochen Teizer and Hans-Joachim Bargstädt	A case study on automated safety compliance checking to assist fall protection design and planning in building information models	*Construction Management and Economics*, (ahead-of-print): 1–14	I	21
2013	Farnad Nasirzadeh and Pouya Nojedehi	Dynamic modeling of labor productivity in construction projects	*International Journal of Project Management*, 31:6, 903–11.	II	39
2013	P. P. A. Zanen, T. Hartmann, S. H. S. Al-Jibouri and H. W. N. Heijmans	Using 4D CAD to visualize the impacts of highway construction on the public	*Automation in Construction*, 32(July): 136–44.	III	68

PREFACE

Developing a collection of the significant works in any area creates the immediate case where the editor is forced to make decisions. The development of this collection was no different. The development of computer technologies in the construction sector covers a broad set of topics and researchers. Although the focus of this set of papers covers less than four decades, the range of topics covered in that time forced difficult decisions to be made concerning what is included and what is left out. However, it is important to recognize up front that this collection of papers is intended to represent significant points in the computer technology field and thus required greater breadth and inclusion of topics than depth in a single sector. Given this caveat, the decisions made in this collection regarding the papers to include were influenced by many factors including pragmatic ones such as page limits and subjective ones such as what are key developments in time and what is an appropriate balance in topics, authors, and sources. Inevitably, there will be papers that some think should have been either included or excluded from the collection.

In an attempt to be as complete as possible in selecting the papers for the set, several perspectives were included in the selection process. First, topics were requested from the community as well as analysed from papers published and personal knowledge of the editor. Given the set of selected topics, citations were used to provide an initial indicator of the papers that have demonstrated impact over an extended period of time. Complementing the citation process was an author analysis to ensure that representation was given to the notable researchers and research groups in each area. Finally, for the historic representation, references from each groundbreaking article were analysed to determine common references and influences. The combination of these approaches provided a solid basis for the selection of the historic and groundbreaking papers in the set.

Unfortunately, quantitative analysis does not provide a thorough basis for emerging and current research efforts. In this case, judgement and community input served to provide significant input for the selection of papers. The intention of these current efforts was to provide an indicator of where each research topic was heading in terms of fundamental or applied research emphasis. It will take another decade of research to determine if these

selections were in fact indicators of the future road that the construction technology domain will take.

Given this attempt to be as impartial as possible, it is still difficult to approach developing a collection without the understanding that inevitably there will be individuals who are overlooked or papers that some would argue should be included but have to be left out. To all of those individuals who believe they were overlooked, I do apologise and ask everybody to understand that this collection is not intended to be exhaustive in content. Rather, I encourage all readers to use this collection as a starting point to understand either the breadth of topics in this domain, or to start an in-depth analysis of a given area. In this manner, the volumes can serve as a starting point for an individual's interest in computing technologies within the construction sector.

Acknowledgements

Putting together a large collection of papers that spans breadth of topics and extended periods of time requires an extensive examination of papers that have been published in numerous outlets. To accomplish this level of analysis requires assistance from a number of individuals. From examining citation lists to printing papers and requesting permissions, the process of putting together this collection was a team effort. As such, some acknowledgements are in order. First, to the broader computer technology research community, I acknowledge and thank you for your assistance in selecting topics for the overall collection. The multiple perspectives provided in this input were invaluable for the final list.

I would also like to thank some special individuals for their critical assistance in developing this set. Carrie Olson was an invaluable assistant in developing this collection. This collection would not have been possible without her many hours of research. Similarly, Robyn Sandekian provided the assistance and support required to get this collection to the completion point. Additional critical coordination was provided by my family with Emily and Sydney assisting in coordinating volumes and Melissa providing the encouragement that in fact this could be accomplished.

In addition to these direct assistance efforts, it is appropriate and essential for me to thank my research collaborators for providing the motivation for completing this recognition of their efforts. Specific appreciation and thanks go out to Raymond Levitt, John Taylor, Amy Javernick-Will, Patricia Carrillo, Andrew Dainty, Ashwin Mahalingam, Michael Garvin, and T. Michael Toole for their long-term support of my interests and for their incomparable work as well as dedication to this field.

Finally, a thank you to Taylor & Francis for their belief in this project and great assistance in getting this work out to the public. I hope all of you enjoy the papers in this collection and that these either motivate or rekindle your interest in exploring computer technologies in the construction sector.