2nd International Workshop on

Durability and Sustainability of Concrete Structures

Final Invitation and Program

6-7 June 2018, Izmailovo Congress Center, Moscow
Preface

Modern construction is unthinkable without concrete, the world production and consumption of which is about 10 billion m$^3$ per year. Given the steady growth of the world’s population by 2050, it is expected to double this volume, which will undoubtedly be significantly affected on energy consumption and increase global CO$_2$ emissions.

Concrete is perhaps the most universal building material since the beginning and development of civilization. It is sufficient to recall the Great Wall of China, the palaces and temples of Ancient India, the pyramids of Ancient Egypt, the unique buildings of Romans, made with the use of lime-pozzolanic binders. Universality of concrete is defined by simplicity and convenience of its production, rather low cost, structural integrity and homogeneity, durability and a long service life under various aggressive environments.

However, the concrete image is sometimes not favorable. It is associated with greater labor intensity of construction works and dismantlement, massive structures, a large impact on the environment in connection with the consumption of not renewable natural resources. The same perception is greatly facilitated by the fact that, according to Gigaton Throwdown Initiative, «the cement industry is responsible for about 5-7% of total CO$_2$ emissions, or 2.1 Gt per year». Indeed, when producing cement clinker about 0.9 t CO$_2$/t clinker are produced. Taking into account the annual increase in the production and use of Portland-based cement (more than 4.1 million tons per year) that is the main binder used in the production of concrete, this fact poses a significant threat to humanity as a whole. According to the Intergovernmental Panel on Climate Change (IPCC), actions are necessary to reduce carbon dioxide emissions because in about 30 years CO$_2$ concentrations is expected to reach 450 ppm – a dangerous point above which irreversible climate change will occur on our planet.

Since concrete will remain the main building material in the future, it is expected that if new ways and mechanisms to reduce the environmental burden by at least 50% will be not found, it is not possible to maintain the existing level of impact.

This problem is so deep and serious that there is hardly a single way to solve it. There is a need for an integrated approach, several complementary activities that provide some synergy.

Until recently, the main efforts were aimed at improving technological processes and reducing the consumption of clinker through the production of blended cements, as well as the creation of new types of binders. Active search for alternative binders has led to the development of sulfoaluminate-based cements; alkali-activated materials and geopolymers (slag, fly ash, metakaolin, etc.), efficient and fairly water-resistant magnesia cements; phosphate cements (ammonium phosphate, silicate phosphate, magnesium phosphate etc.), cements with calcium halogen-aluminates and the so called low water demand...
binders.

With the advent of high-performance concretes and new technologies, the possibility of a radical increase of the cement factor in conventional concrete due to the use of high-performance superplasticizers and other chemical admixtures, dramatically reducing the water consumption of the concrete mixture; active mineral additives such as micro silica, metakaolin, fly ash, finely ground granulated slag, etc., as well as a variety of inert fillers that can improve the functionality of concrete mixtures, such as fine limestone. Strictly speaking, «pozzolanic effect» and «filler effect» are easily combined and provide a certain synergy.

The potential for reducing cement consumption in concrete production is still undervalued. This is due to certain fears of decreasing the corrosion resistance of concrete and durability of reinforced concrete structures, since the great bulk of the existing standards is prescriptive and sets the minimum cement content in concrete under specific operating conditions.

Reinforced concrete structures of buildings and constructions, as a rule, initially, shall have the design strength and sufficiently long service life because their construction often requires a significant investment. The durability of these structures, however, is determined by different ageing processes and the influence of external actions, so their life will be limited. As a result, many structures need to be repaired or even replaced in fairly short time periods, resulting in additional costs and additional environmental impacts. Therefore, there is a need to improve the design principles of structures taking into account the parameters of durability and thus achieving a sufficiently long service life.

Development of the concept of design of structures based on their life cycle, «environmental design», including a holistic approach that optimizes material and energy resources in the context of operating costs, allow us to completely revise our ideas about structural concrete construction.

It should be noted that many recent developments in the field of life cycle analysis (LCA) are aimed at expanding and deepening traditional approaches and creating a more complete description of the processes with the analysis of sustainable development (LCSA) to cover not only the problems associated mainly with the product (product level), but also complex problems related to the construction sector of the economy (at the sector level) or even the general economic level (economy level).

The approach to «environmental design» is based on such models and methods of design, which takes into account a set of factors of their impact on the environment, based on the concept of «full life cycle» or models of accounting for total energy consumption and integrated CO₂ emission.

All of this could become a basis for the solution of the global problem – to contain the growing burden on the environment, providing a 50% reduction in CO₂ emissions and energy consumption in the construction industry. Hence a special sharpness P. K. Mehta’s phrase acquires: «...the future of the cement
and concrete industry will largely depend on our ability to link their growth for sustainable development...”

The above-mentioned acute and urgent problems form the basis of the agenda of the Second edition of International Workshop on “Sustainability and Durability of Concrete Structures – DSCS-2018”, held in Moscow on 6 – 7 June 2018 under the auspices of the American Concrete Institute, the International Federation on structural concrete and the International Union of experts and laboratories in the field of building materials, systems and structures. The selected papers of this major forum, which brought together more than 150 experts from almost 40 countries of the world, are collected in this ACI SP.

Vyacheslav Falikman, Roberto Realfonzo,
Chair of Organizing Committee

Luigi Coppola, Petr Hajek, Paolo Riva,
Members of Organizing Committee

2nd International Workshop on
Durability and Sustainability of Concrete Structures
6-7 June 2018, Izmailovo Congress Center, Moscow

On behalf of the Organizing Committee it is a great honor for us to host the 2nd International Workshop on Durability and Sustainability of Concrete Structures in Moscow, Russia on June 6-7, 2018. The 2nd International Workshop on Durability and Sustainability of Concrete Structures brings together leading experts from all parts of the world. The purpose of this International Workshop is to present and discuss the most innovative latest developments in materials technology and researches on durability and sustainability of concrete construction.

The Workshop will gather professionals and academics from different countries to exchange knowledge and experience, to present the results of scientific research and to discuss innovations in durability and sustainability of concrete construction. Top universities specializing in Structural Concrete will participate in the Congress. The workshop is organized by the American Concrete Institute Italy Chapter and the Russian Engineering Academy with the assistance of the Russian Academy of Sciences and the Russian Academy of Architecture and Construction Science.

We are very pleased to welcome you to attend and we are sure you will enjoy the Workshop from both scientific and social points of view. We are ready and happy to help you to organize your trip to Russia and arrange everything so as to make your stay in Russia pleasant! We would be glad to assist you in accommodation, as well as transfer and excursion services and visa support.
Looking forward to meeting you in Moscow!

The purpose of this International Workshop is to present and discuss the most innovative developments and researches on durability and sustainability of concrete construction.

The workshop is organized by the American Concrete Institute Italy Chapter (ACI IC) and the Russian Engineering Academy (REA) with the assistance of the Russian Academy of Sciences (RAS) and the Russian Academy of Architecture and Construction Science (RAACS). The Workshop is co-sponsored by American Concrete Institute (ACI) and its Committees: C130 (Sustainability of Concrete), C201 (Durability of Concrete), C446 (Fracture Mechanics of Concrete - Joint ACI/ASCE), C544 (Fiber Reinforced Concrete), C549 (Thin Reinforced Cementitious Products and Ferrocement).

The workshop is also co-sponsored by the Federation for Structural Concrete (fib) and the International union of laboratories and experts in construction materials, systems and structures (RILEM).

**Topics of the conference (will include but are not limited to)**

- Reduction in Green House Gases in Cement and Concrete Industry
- Recycled Materials and Waste Management in Mortar and Concrete Production
- Solfoaluminate based cement alternative to portland and portland blended cements
- Alkali-activated materials and geopolymers for sustainable construction
- Durability of Reinforced Concrete Structures
- Life Cycle Cost Assessment in Concrete Construction
- Reuse and Functional Resilience of Reinforced Concrete Structures
- Repair and Maintenance
- Testing, Inspection and Monitoring
- Case Histories
Key speakers

Nemy Banthia is a Professor, Distinguished University Scholar and a Senior Canada Research Chair in Infrastructure Rehabilitation and Sustainability at the University of British Columbia. He is the Fellow of American Concrete Institute, Canadian Society for Civil Engineering, Indian Concrete Institute, Canadian Academy of Engineering and Royal Society of Canada and awarded with many prestige prizes. Prof. Banthia serves on Editorial Boards of eight international journals and is the Editor-in-Chief of the Journal of Cement and Concrete Composites. Recently, Dr. Banthia was invited by Prime Minister of Canada to lead the Canada-India Research Center of Excellence (IC-IMPACTS) as its Scientific Director and CEO. Supported by both Indian and Canadian Governments, the Center is involved in applied research with India in Water, Infrastructure and Public Health and is dedicated to bringing advanced technologies to communities in Canada and India.

Ravindra Gettu is the Dean for Consultancy & Sponsored Research, and Professor of Civil Engineering at the Indian Institute of Technology (IIT) Madras, Chennai, India. After his PhD from the Northwestern University (USA) in 1990, he was the Director of the Structural Technology Laboratory of the Technical University of Catalonia in Barcelona, Spain until 2004. His research interests are in the areas of concrete technology, effective use of admixtures, self-compacting concrete, fiber-reinforced concrete, life-cycle assessment, etc. He is President-elect of RILEM, the International Union of Laboratories and Experts in Construction Materials, Structures and Systems, based in Paris, and very active in the Indian Concrete Institute. He has consulted for many leading construction materials manufacturers and projects.

Boris V. Gusev is Corresponding Member of the Russian Academy of Sciences, Doctor of Science (Tech.), Professor and Head of a Department at Moscow State University of Railway Engineering (MIIT), President of the International and Russian Engineering Academies. V. Gusev is a prominent scientist and an administrator of science, education and enlightenment. Prof. Gusev serves on Editorial Boards of many national journals and is the Editor-in-Chief of the Journal of Industrial and Civil Engineering and Electronic Edition «Nanotechnologies in Construction: A Scientific Internet-Journal». He was rewarded by the USSR and Russian State Awards, five Russian Government Awards, and various orders and medals, as well as other prestigious government awards from the former Soviet Union, Armenia, Kazakhstan, and Ukraine, including many industrial and civilian awards from these countries.
R. Douglas Hooton is a Professor and NSERC/Cement Association of Canada, Senior Industrial Research Chair in Concrete Durability and Sustainability in the Department of Civil Engineering at the University of Toronto where he has taught for more than 30 years. ACI Fellow, he serves on the ACI Board of Directors; Chairs ACI committee C233 on Slag Cement, ACI C130A on Sustainability of Materials; Secretary and in-coming Chair of ACI C201 on Durability. Prof. Hooton is also Chair of the RILEM Educational Activities Committee. His research involves finding ways to reduce the greenhouse gas emissions associated with concrete infrastructure and has informed the specification codes associated with the American Concrete Institute, the Canadian Standards Association and ASTM standards.

Harald S. Müller is Professor Emeritus at the Karlsruhe Institute of Technology (KIT) in Germany. His main research areas are concrete structures with a special focus on the investigation and prediction of the structural behavior of concrete such as creep and shrinkage, but also the development of new types of concretes as well as service life design and management. Prof. Müller is the Immediate Past President and Honorary President of the International Federation for Structural Concrete (fib) and a member of various international scientific committees and standardization organizations such as ACI, CEN, RILEM and others. He was awarded many national and international prizes.

Surendra P. Shah is Walter P. Murphy Professor of Civil Engineering (Emeritus) at Northwestern University, Evanston, IL. ACI Honorary Member, he is a member of ACI Committees 215, Fatigue of Concrete; 239, Ultra-High Performance Concrete; 241, Nanotechnology of Concrete; 544, Fiber-Reinforced Concrete, 548, Polymers and Adhesives for Concrete; and 549, Thin Reinforced Cementitious Products and Ferrocement. He is also a member of Joint ACI-ASCE Committee 446, Fracture Mechanics of Concrete. Shah’s current research projects include nanotechnologies in construction, hybrid fiber reinforced cement-based composites, the interaction between microcracking and transport properties, monitoring in-situ properties of concrete at an early age using ultrasonic method, computational model for fatigue fracture, utilization of waste material, early age cracking of high-performance concrete, self-compacting concrete and extruded composites. As a noted expert in the fields of concrete materials and nondestructive testing, Prof Shah has been elected to the National Academy of Engineering.
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- Viktor Mechtcherine (Germany)
- Marco Menegotto (Italy)
- Guenther Meschke (Germany)
- Giacomo Moriconi (Italy)
- Harald S. Muller (Germany)
- Antonio Nanni (USA)
How to get to Izmailovo Congress Centre

Address: 71A, Izmailovskoye Highway, Moscow, 105613, Russia
Metro «Partizanskaya» (former Izmailovskiy park)

Contacts on registration, payment, accommodation, visas, transfers, excursions

If you have any questions please do not hesitate to contact us:

e-mail: info@dscs2018.ru
tel: +7 (495) 134-25-65
address: 101 Prospekt Mira, 129085, Moscow, Russia
От имени правительства Москвы и Комплекса градостроительной политики и строительства г. Москвы приветствую будущих участников 2-го Международного симпозиума по проблемам устойчивого развития и долговечности конструкционного бетона.

Нам приятно, что Симпозиум будет проходить в одном из самых динамично развивающихся городов мира в столице России – Москве. Уникальные архитектурные сооружения делового комплекса «Москва-Сити», Храма Спасителя и Мемориала на Поклонной горе, многочисленные стадионы и торговые комплексы, уникальные объекты инфраструктуры – все это отражение достижений строителей современной России.

В градостроительной практике г. Москвы бетон и железобетон играют исключительно важную роль. Не только во всех наиболее престижных проектах, реализованных в Москве в начале ХХI века, но и в основном объеме жилищного и гражданского строительства сегодня используется преимущественно бетон и железобетон.

Строительная программа города на ближайшую перспективу также исключительно обширна: это реконструированные промышленные зоны и жилые микрорайоны, новые высотные здания, сложные магистральные развязки и четырехполосные дороги, более 20 новых станций метрополитена и многое-многое другое.

Строительный комплекс Москвы насчитывает сотни тысяч рабочих, инженеров, ученых, преподавателей, проектировщиков и других высококвалифицированных специалистов, десятки предприятий стройиндустрии, тысячи единиц строительной техники.

Сейчас, как никогда, московским стройкам нужен современный бетон - прочный, эстетически привлекательный и долговечный, позволяющий реализовать смелые замыслы наших архитекторов. Качество строительства, его социальная значимость становятся центральной задачей. Понятие «устойчивое развитие» довольно прочно вошло в нашу сегодняшнюю жизнь.

Москва гордится не только замечательными зданиями и сооружениями, построенными в последнее время, она гордится своей древней историей, огромным вкладом в российскую культуру и становление российской государственности.

Делегаты Симпозиума из многих стран мира, различных регионов и городов России будут иметь возможность не только обсудить со своими коллегами проблемы, связанные с развитием бетона и железобетона,
но и посмотреть достопримечательности Москвы, побывать на наиболее интересных стройплощадках города.
Симпозиум послужит формированию у его участников ощущения принадлежности к единому корпусу специалистов—железобетонщиков, играющих ключевую роль в международной и российской строительной индустрии.
Желаю всем активного и плодотворного проведения предстоящего Симпозиума и приятного знакомства с Москвой.

М.Ш. Хуснуллин,
Заместитель Мэра Москвы
в Правительстве Москвы
по вопросам градостроительной политики и строительства
Program
(Small changes could be made)

DAY 0 – June 5, 2018
17:00 - 19:00 Registration
19:00 - 21:00 Welcome Reception

DAY 1 – June 6, 2018

PLENARY SESSION (10:00 - 10:30)
Keynote Lecture #1 - N. Banthia
Bio-Inspired, Internally Cured Cellulose Fiber Reinforced Concrete for Next Generation Infrastructure by N. Banthia, O. Onuaguluchi and D. Cui

PARALLEL SESSIONS (10:30-11:30)

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PLENARY SESSION (15:00 - 16:00)

Keynote Lecture #2 - H. Muller

Design approach and properties of a new generation of sustainable structural concretes by Harald S. Müller, Michael Haist, Michael Vogel and Jack S. Moffatt

B. Gusev - Towards the 150th anniversary of the Periodic system of elements: new 3D-spiral matrix approach

PARALLEL SESSIONS (16:30-18:00)

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DAY 2 – June 7, 2018

PLENARY SESSION (09:30 - 10:30)
Keynote Lecture #3 - R. Gettu
Considerations of sustainability in the mixture proportioning of concrete for strength and durability by Ravindra Gettu, Radhakrishna G. Pillai, Jyotiprakash Meena, Anusha S. Basavaraj, Manu Santhanam, and B.S. Dhanya
Keynote Lecture #4 - S. Shah
Nano-Engineered Meta Cement-Based Materials and Durability by Surendra P. Shah, Pengkun Hou

PARALLEL SESSIONS (10:30-11:30)

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## PLENARY SESSION (14:30 - 15:00)

Keynote Lecture #5 - D. Hooton
Benchmarking Accelerated Performance Test Methods with Long-term Testing
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### PARALLEL SESSIONS (17:00-18:00)

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<th>NC2</th>
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18:00-18:30 Closing DSCS-2018

DAY 3 – June 8, 2018
10:00-13:30 Technical visits
Day 0 (June 5)
17:00 - 19:00 Registration - Conference hall №5
19:00 - 21:00 Welcome Reception - Conference hall №5

Day 1 (June 6)
08:30 - 09:00 Registration - Conference hall №5
09:00 - 10:00 Opening welcome. Presentations of International organizations (ACI, fib, RILEM) - Conference hall №1
10:00 - 10:30 Keynote Lecture #1 - N. Banthia - Conference hall №1
10:30 - 11:30 Parallel Sessions: DU1 - Conference hall №1, AA1 - Conference hall №2, AD1 - Conference hall №3, SC1 - Conference hall №6
11:30 - 12:00 Coffee break - Conference hall №5
12:00 - 13:30 Parallel Sessions: RS1 - Conference hall №1, GC1 - Conference hall №2, FRC1 - Conference hall №3, CS1 - Conference hall №6
13:30 - 15:00 Lunch break - Second Floor
15:00 - 15:30 Keynote Lecture #2 - H. Muller - Conference hall №1
15:30 - 16:00 «Towards the 150th anniversary of the Periodic system of elements: new 3D-spiral matrix approach» – B. Gusev
16:00 - 16:30 Coffee break - Conference hall №5
16:30 - 18:00 Parallel Sessions: DU2 - Conference hall №1, GC2 - Conference hall №2, NC1 - Conference hall №3, SC2 - Conference hall №6

Day 2 (June 7)
09:30 - 10:00 Keynote Lecture #3 - R. Gettu - Conference hall №1
10:00 - 10:30 Keynote Lecture #4 - S. Shah - Conference hall №1
10:30 - 11:30 Parallel Sessions: AD2 - Conference hall №1, EC1 - Conference hall №2, FRC2 - Conference hall №3
11:30 - 12:00 Coffee break - Conference hall №5
12:00 - 13:00 Parallel Sessions: RS2 - Conference hall №1, EC2 - Conference hall №2, AD3 - Conference hall №3
13:00 - 14:30 Lunch break – Second floor
14:30 - 15:00 Keynote Lecture #5 - D. Hooton
15:00 - 16:30 Parallel Sessions: DU3 - Conference hall №1, GC3 - Conference hall №2, SU1 - Conference hall №3
16:30 - 17:00 Coffee break - Conference hall №5
17:00 - 18:00 Parallel Sessions: NM1 - Conference hall №1, AA2 - Conference hall №2, NC2 - Conference hall №3
18:00 - 18:30 Conclusion
20:00 - Gala Dinner

Day 3 (June 8)
09:00 - 13:00 Technical visits:
1. High-rise buildings in Moscow City (https://anashina.com/moscow-city/)
2. Visit to the Moscow State University of Civil Engineering

Legenda:
AA = Alkali-Activated binders/concretes
AD = Admixtures
CS = Case Studies
DU = Durability
EC = Extreme Condition
FRC = Fiber Reinforced Concrete
GC = Green Concrete
NC = New/Novel Concretes
NMR = Non-Metallic Reinforcement
RS = Repair & Strengthening
SU = Sustainability
SC = Sulphoaluminate Cements
Cultural program - Russian tourism

Weather in Moscow in June: from +20 to +30 °C.

Medicine: In case you need any special medicine, please do not forget to take it with you.

Cash: We kindly advise you not to change the money at the airport, because of unfavorable exchange rate. You can easily find ATM anyplace in Moscow. In general, 200-500 $ changed or withdrawn in rubles should be enough. You can use credit cards Visa and MasterCard mostly everywhere in Moscow but please mind that some small shops and souvenirs shops may not take cards.

Power sockets: please mind the power sockets format in Russia. It is C and F types.

We are happy to invite you to excursions organized by MAKO Agency. Please use your DSCS Travel cabinet to book an excursion ticket in advance. The option will be available soon.

Places to visit:
1. The Red Square
2. Lenin’s Mausoleum, Kremlin
3. The Cathedral of Vasily the Blessed
4. The Bolshoy theatre
5. Monastery and Cemetery Novodievitchi
   1. The Cathedral of Christ the Saviour
   2. The Pushkin State Museum of Fine Arts
   3. The Tretyakov Gallery
   4. Gorky Central Park of Culture and Leisure
   5. Flea Market in the IzmailovoVernissage
6. Central Museum of the Armed Forces
Dear participants we are glad to invite you to the north capital of Russia — St. Petersburg

EXCURSION: 2-3 DAYS PROGRAM
English-speaking guide will be with you during the whole tour

1. Sightseeing tour of St. Petersburg
On the agenda is the St. Isaac’s Cathedral, a magnificent neo-classical style landmark, the Admiralty building, the headquarters of the Russian Navy, Alexander Gardens.
Palace Square. Here you’ll see the Alexander Column, a monument built in the early 19th century to remember the Russian military’s victory during the war against Napoleon’s France. Also you will see 19th century Kazan Cathedral, a landmark dedicated to Our Lady of Kazan, Anichkov Palace and the Anichkov Bridge where you can take a nice long stroll across and enjoy the peaceful views of the Fontanka River and watch as the boats pass underneath you. Last but not least are the Summer Gardens, commissioned by Peter the Great. This atmosphere here is truly idyllic as you’ll pass some incredible statues and the remarkable water fountain right in the heart of the park. Just relax and enjoy the view.
Also you will see Peter and Paul Fortress, founded by Peter the Great in the early 18th century. Look out for the Bronze Horseman — it’s a great big statue of Peter the Great riding a horse in the middle of Senate Square.

2. Excursion to the Hermitage

3. Excursion through the St. Petersburg channels

Price includes train tickets and transport logistics under the program, accommodation in the hotel Oktyabrskaia **** SNGL room, excursions with admission tickets, meals, guide-interpreter.

Prices for the excursion according to the chosen category of train and quantity of days

09.06-10.06.2018

<table>
<thead>
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<th>Fast train – Supsan</th>
<th>Night train</th>
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<td>Moscow-St Peterburg-Moscow</td>
<td>Moscow-St Peterburg-Moscow</td>
</tr>
<tr>
<td>37 000 rubles.</td>
<td>38 000 rubles.</td>
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<tr>
<td>Moscow – St Peterburg</td>
<td>Moscow – St Peterburg</td>
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<tr>
<td>32 000 rubles.</td>
<td>32 000 rubles.</td>
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<tr>
<td>08.06-11.06.2018</td>
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Second variant will contain excursion program 11.06.2018.
We would like to thank all of the sponsors for their generous support and collaboration with the event.

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