

Das System Gebäude

Building as a system

Prof. Dirk E. Hebel

Assistant Professorship of Architecture and Construction
Future Cities Laboratory Singapore / ETH Zürich

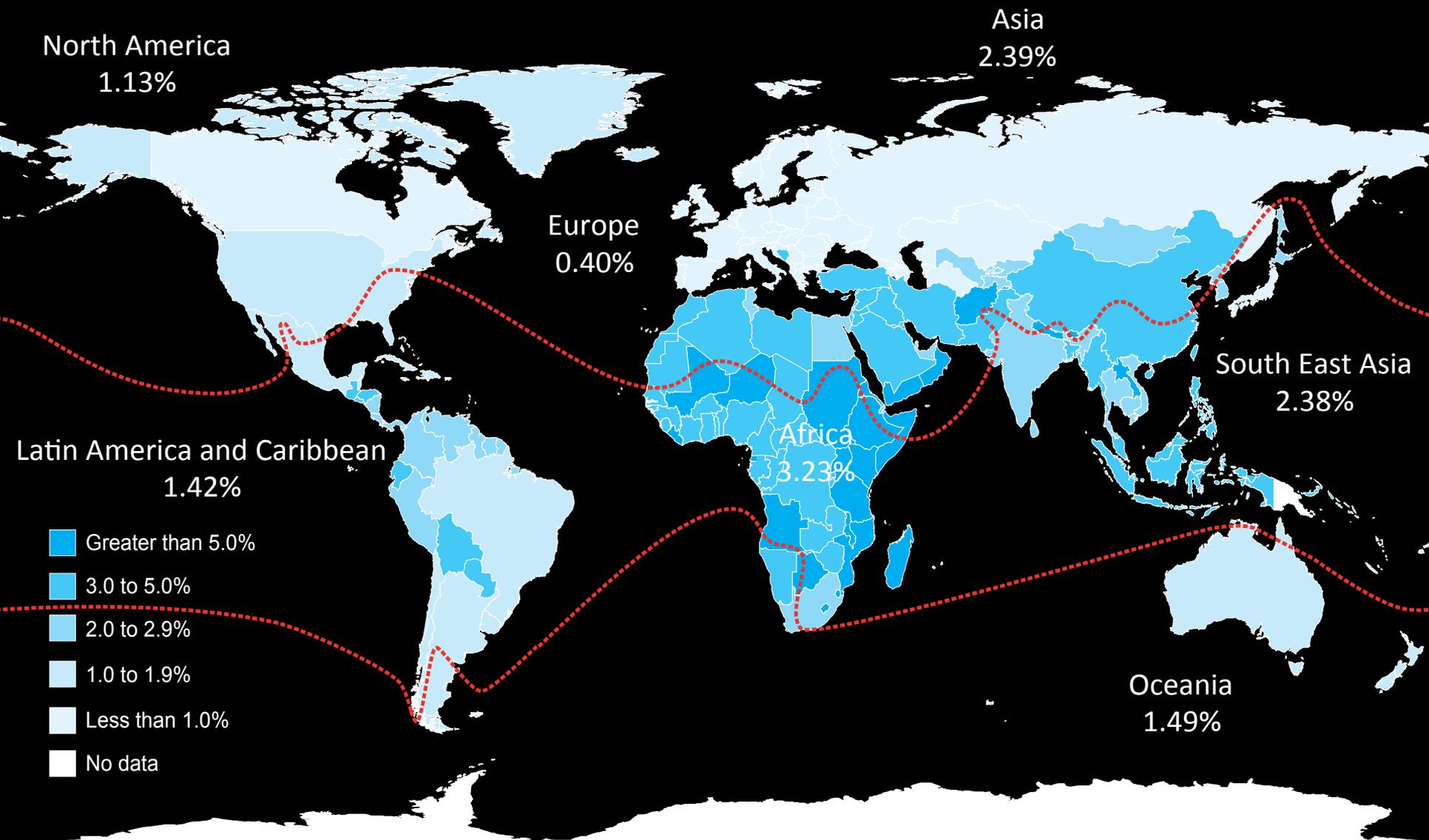
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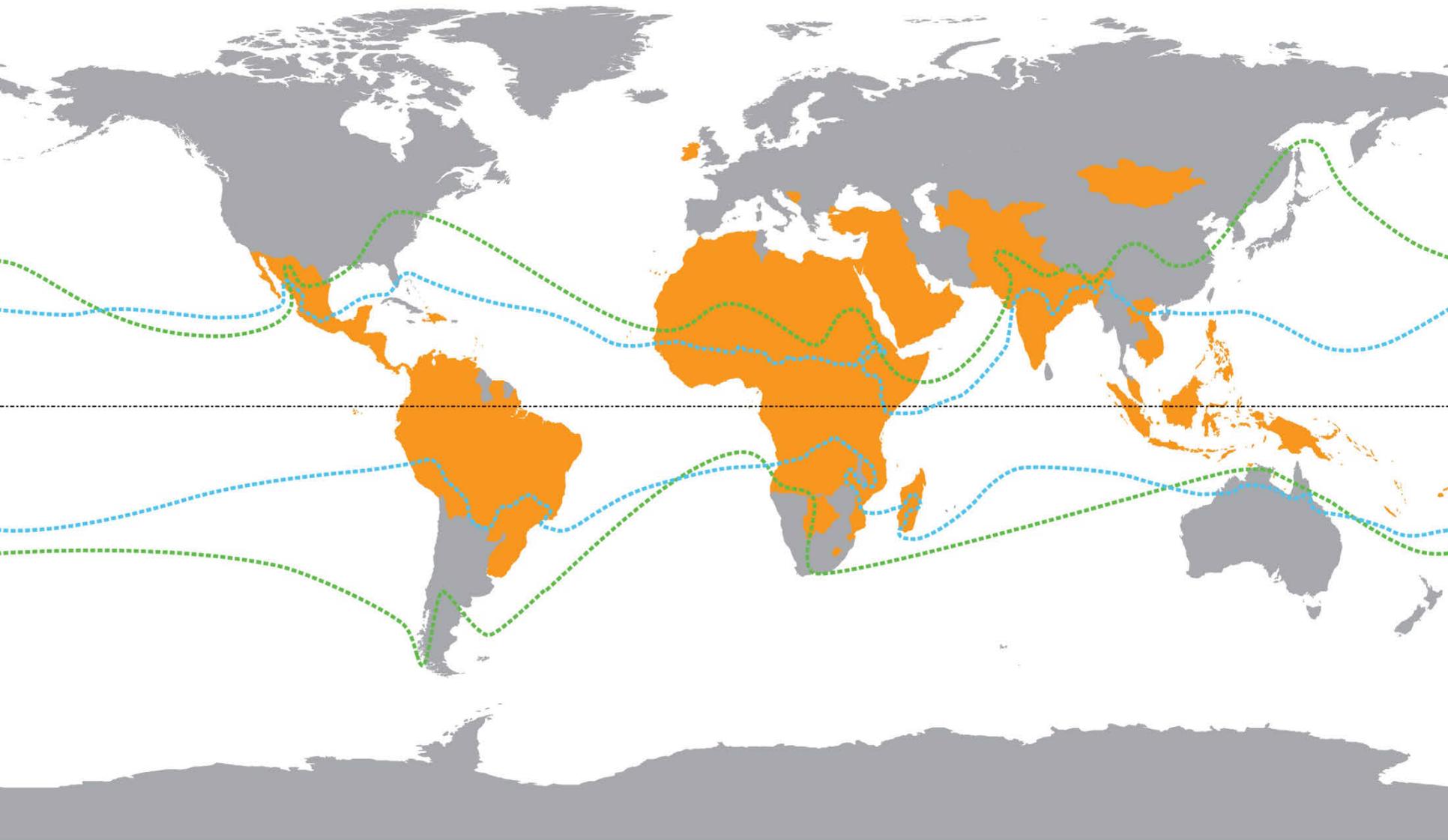
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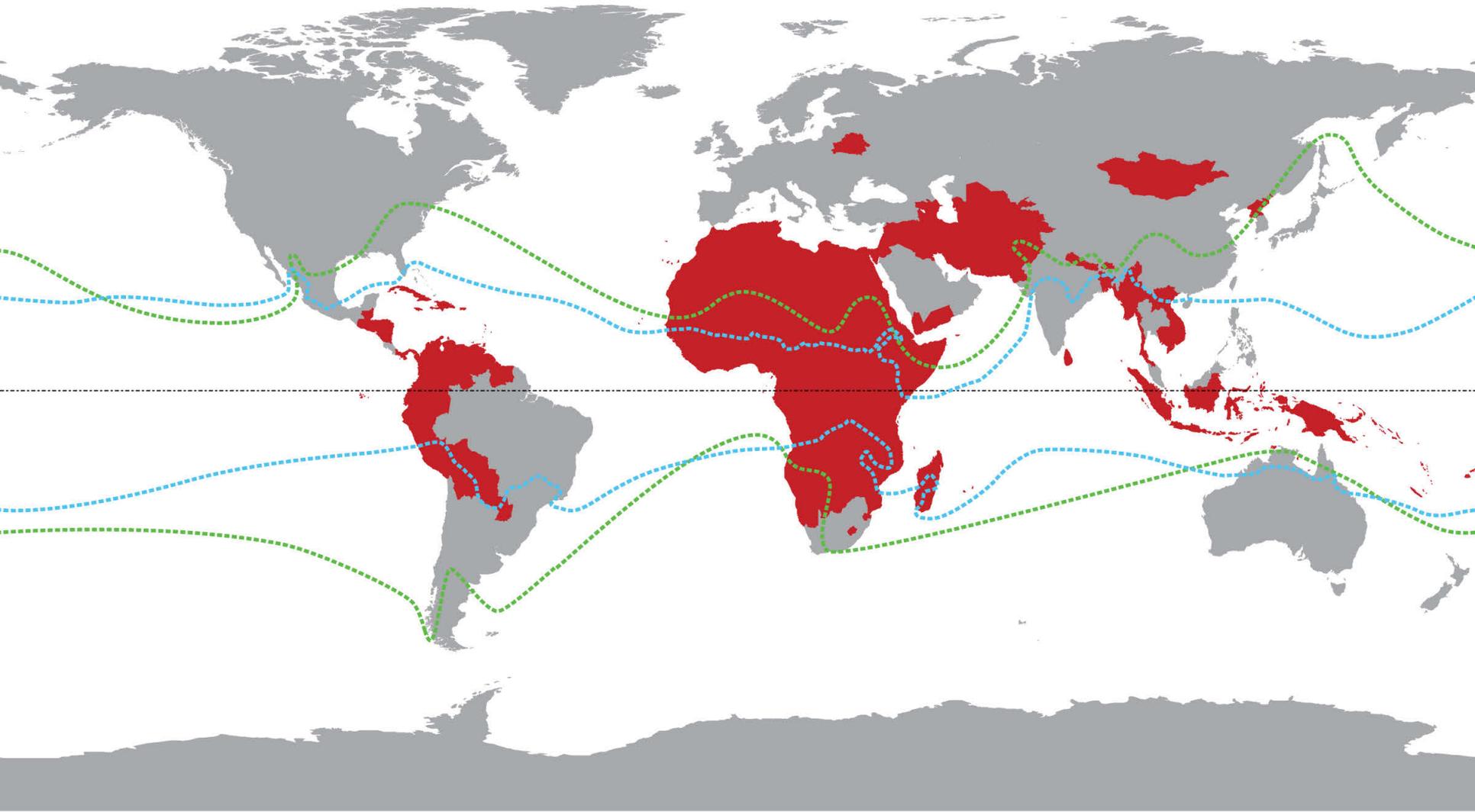
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Population Growth
 countries with a population growth above 1%
 US Census (2007)



Developing Countries
excluding NIC (Newly Industrialized Countries) and EMGP (Emerging Markets Global Players)
World Bank (2011)

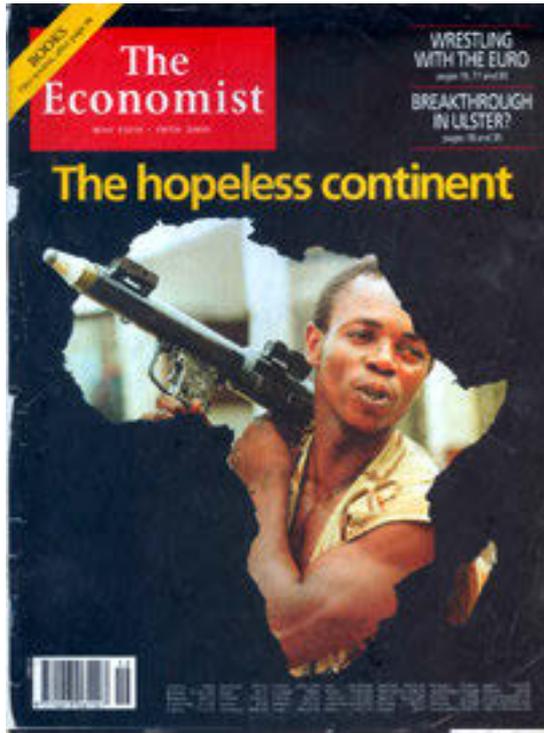
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2000



2011

fastest growing economies

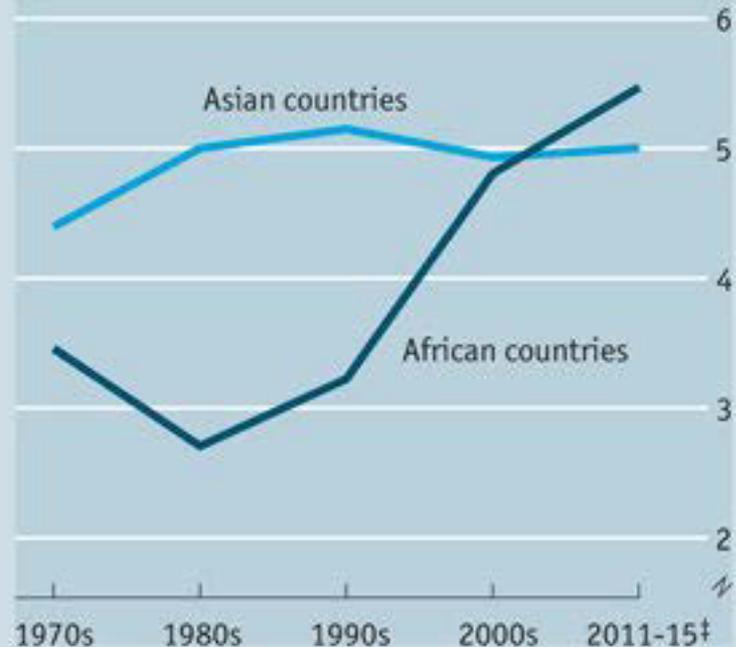
World's ten fastest-growing economies*

Annual average GDP growth, %

2001-2010†		2011-2015‡	
Angola	11.1	China	9.5
China	10.5	India	8.2
Myanmar	10.3	Ethiopia	8.1
Nigeria	8.9	Mozambique	7.7
Ethiopia	8.4	Tanzania	7.2
Kazakhstan	8.2	Vietnam	7.2
Chad	7.9	Congo	7.0
Mozambique	7.9	Ghana	7.0
Cambodia	7.7	Zambia	6.9
Rwanda	7.6	Nigeria	6.8

Sources: *The Economist*; IMF

GDP growth, unweighted annual average, %



*Excluding countries with less than 10m population and Iraq and Afghanistan †2010 estimate ‡Forecast

AFRICA: THE NEXT BIG ECONOMIC BOOM



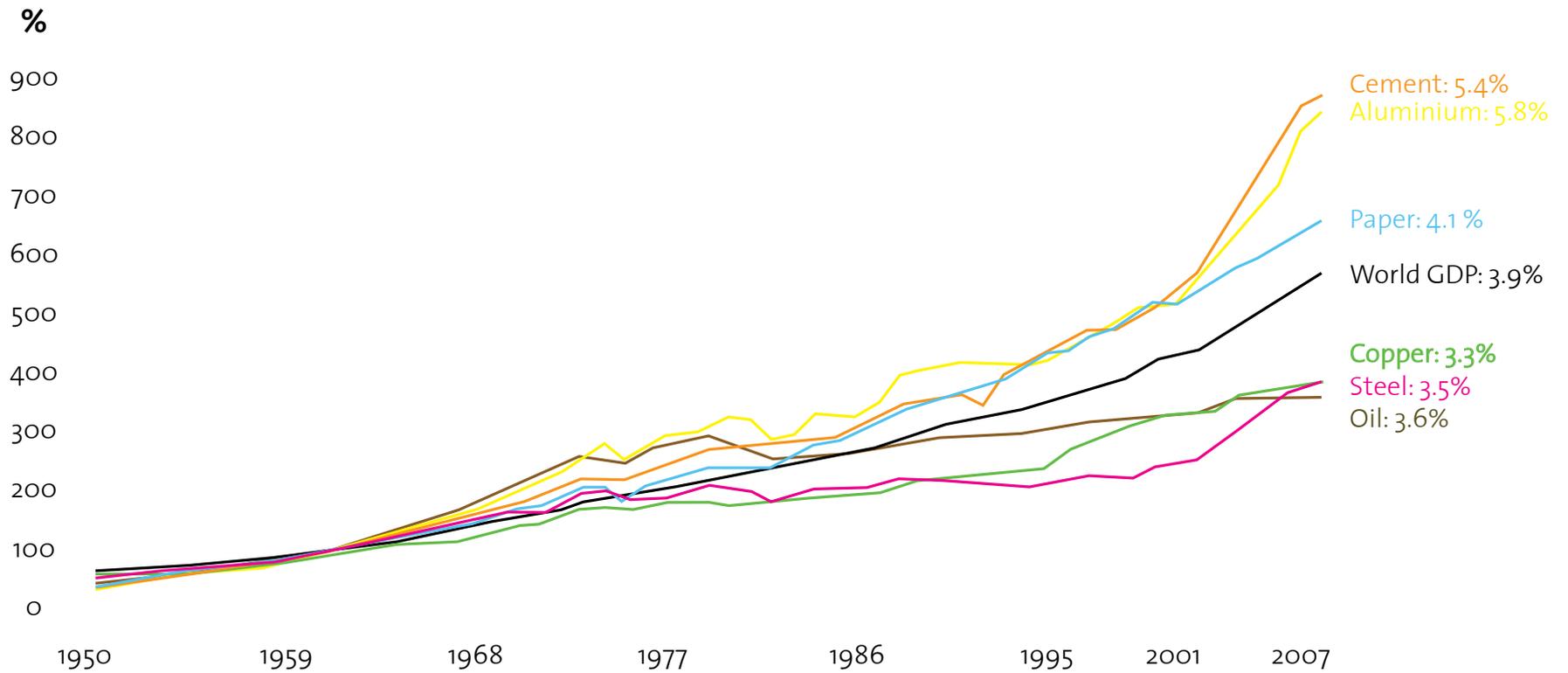
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Basic Materials Consumption World

Maddison database, BP, US Geological Survey, ICR, Cembureau 2011



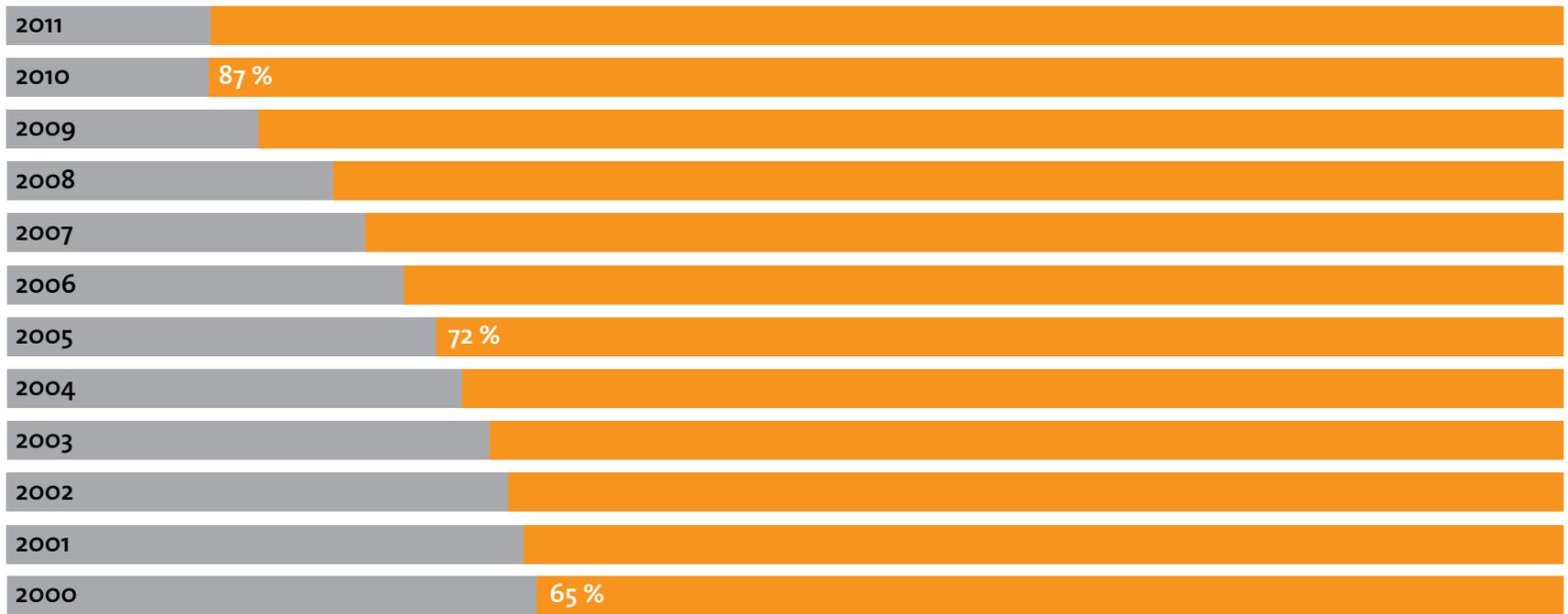
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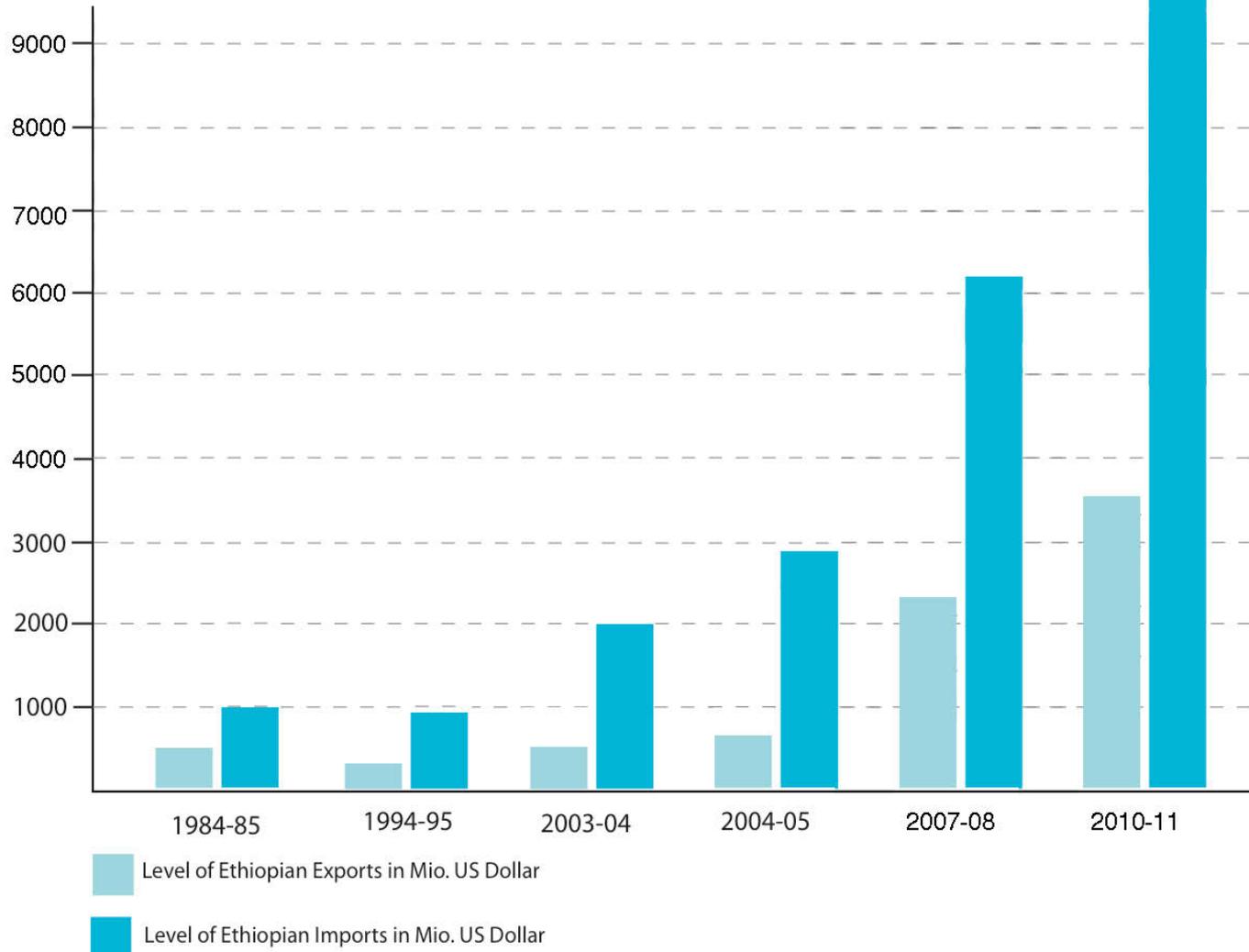
Developed Countries

Emerging & Developing Countries

Regional Share in World Cement Demand

Ernst & Young (2012)

Level of Ethiopian Exports and Imports in Mio. US Dollar





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EiABC Ethiopian Institute of Architecture Building Construction and City Development

Addis Ababa University

SUDU

SUSTAINABLE URBAN DWELLING UNIT

EIABC PRESENTS IN COOPERATION WITH THE FEDERAL INSTITUTE OF TECHNOLOGY (ETH) IN ZÜRICH:

ETHiopia Urban Laboratory: The SummerSchool

June 28th - July 18th 2010, Addis Ababa, Ethiopia

Context

Within the next 15 years, Ethiopia will be confronted with an additional 45 million people with the basic needs of food, water, safety and shelter in already over-strained or not yet existing urban settlements. The next decades will be fundamental in shaping the long-term future of the country, but the methods, instruments and ideas needed for this urgent development are still to be identified. The interdisciplinary ETHiopia Summer School will bring together faculty members and students from ETH Zürich and the Ethiopian Institute of Architecture, Building Construction and City Development (EiABC) to investigate the most critical topics regarding Ethiopia's development and to take practical steps towards a sustainable solution.

Goal

A full-scale, low-cost prototype building in the form of a SUDU (Sustainable Urban Dwelling Unit) will be the primary outcome of the summer school. The offered case studies will not only provide hands-on methods for sustainable urban development in Addis Ababa, but also offer a vision for other regions in Africa. Follow-up projects are expected to build upon the first experiences both within Ethiopia and elsewhere.

Outline

The ETHiopia SummerSchool will be composed of 12 students from the ETH Zürich and 20 students from EiABC in addition to faculty members with different fields of expertise. The summer school will consist of four thematic tracks:

- Architecture and Construction
- Entrepreneurship
- Water and Sanitation
- Energy

During first week, all students will receive an introduction to all topics relevant to the SUDU project and development work in general. This will be achieved through a series of lectures by Ethiopian and international experts. In weeks 2 and 3, all involved partners will work on the full scale SUDU project as an integrated design project with different thematic tracks. The work will be exhibited at the end of the summer school in the completed SUDU with invited guests from the government, city administration and academia.

Date

June 28th - July 18th 2010 at EiABC Addis Ababa, Ethiopia

Application

All parties of EiABC, AAT, AAU, other academic institutions and the private sector are invited to participate. Please contact the SUDU Team for any information and ideas.

We especially invite students to be part of the SUDU team and work with students from the ETH in a very close relationship. Please apply in the Management Office of EiABC, Scientific Director Dirk Hebel and leave a one-page information sheet with your name, phone number, email and other contacts.

Costs

EiABC will cover all costs regarding the working materials necessary during the program. Participants must cover personal expenses and meals during the program.

Project Team EiABC:

Prof. Herbert Schmitz, EiABC
Prof. Dr. Elias Yiparek, EiABC
Tabata Daniel, EiABC

Dirk Hebel, Scientific Director EiABC, ETH Zürich

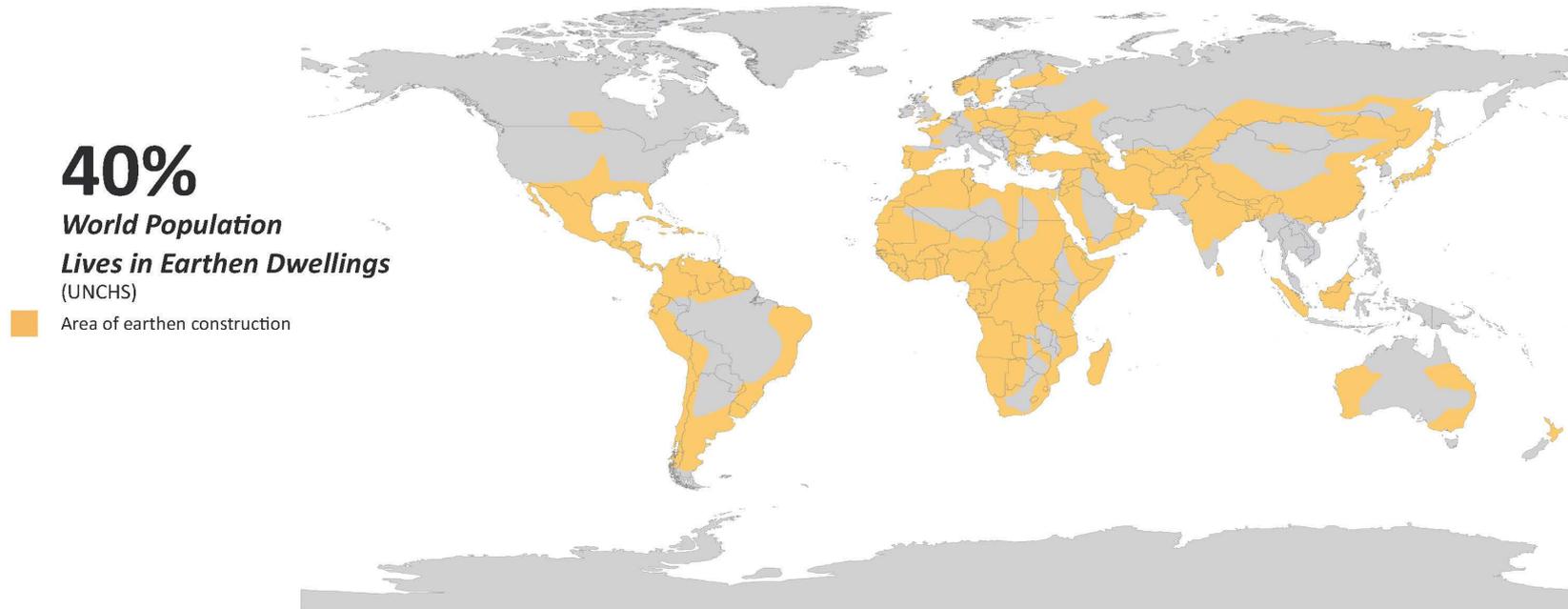
ETH sustainability
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 North-South Centre
Research for Development

 EiABC
Ethiopian Institute of Architecture,
Building Construction and City Development
Addis Ababa, Ethiopia
www.eiabc.org

DARCH
Department Architektur
Faculty of Architecture

GLOBAL DISTRIBUTION OF EARTHEN MASONRY CONSTRUCTION:



Drawing After: Gandreau and Delboy, 2010

SOIL AS A BUILDING MATERIAL

- Almost all soils can be adapted for construction
- Locally available & abundant
- Inexpensive
- Low Carbon footprint
- Reduces use of imported materials
- Invests capital in local production & labor economies



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ETHiopia Urban Laboratory: SRDU

A RESEARCH PROJECT FUNDED BY WASER FOUNDATION



WASER FOUNDATION
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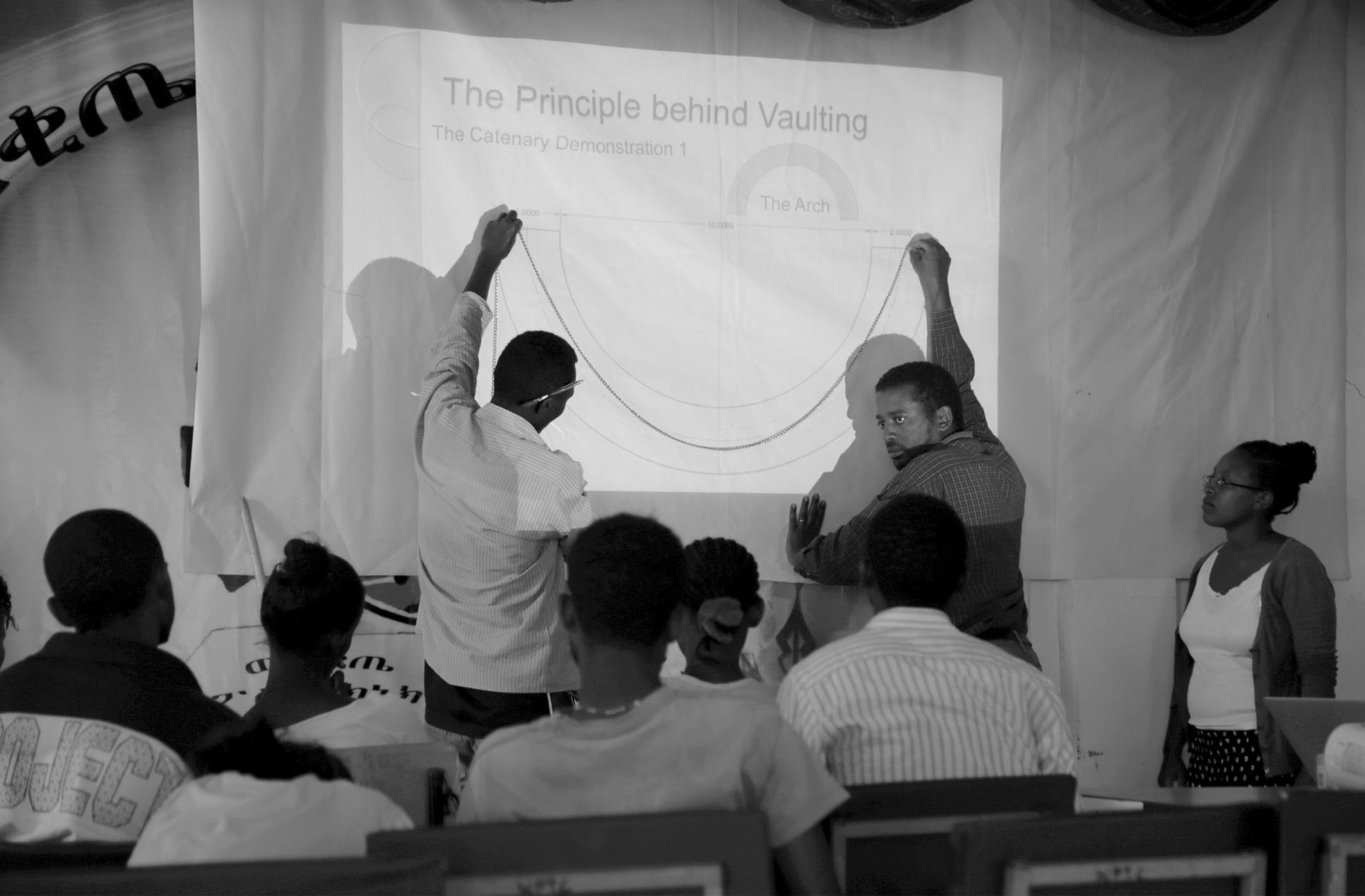
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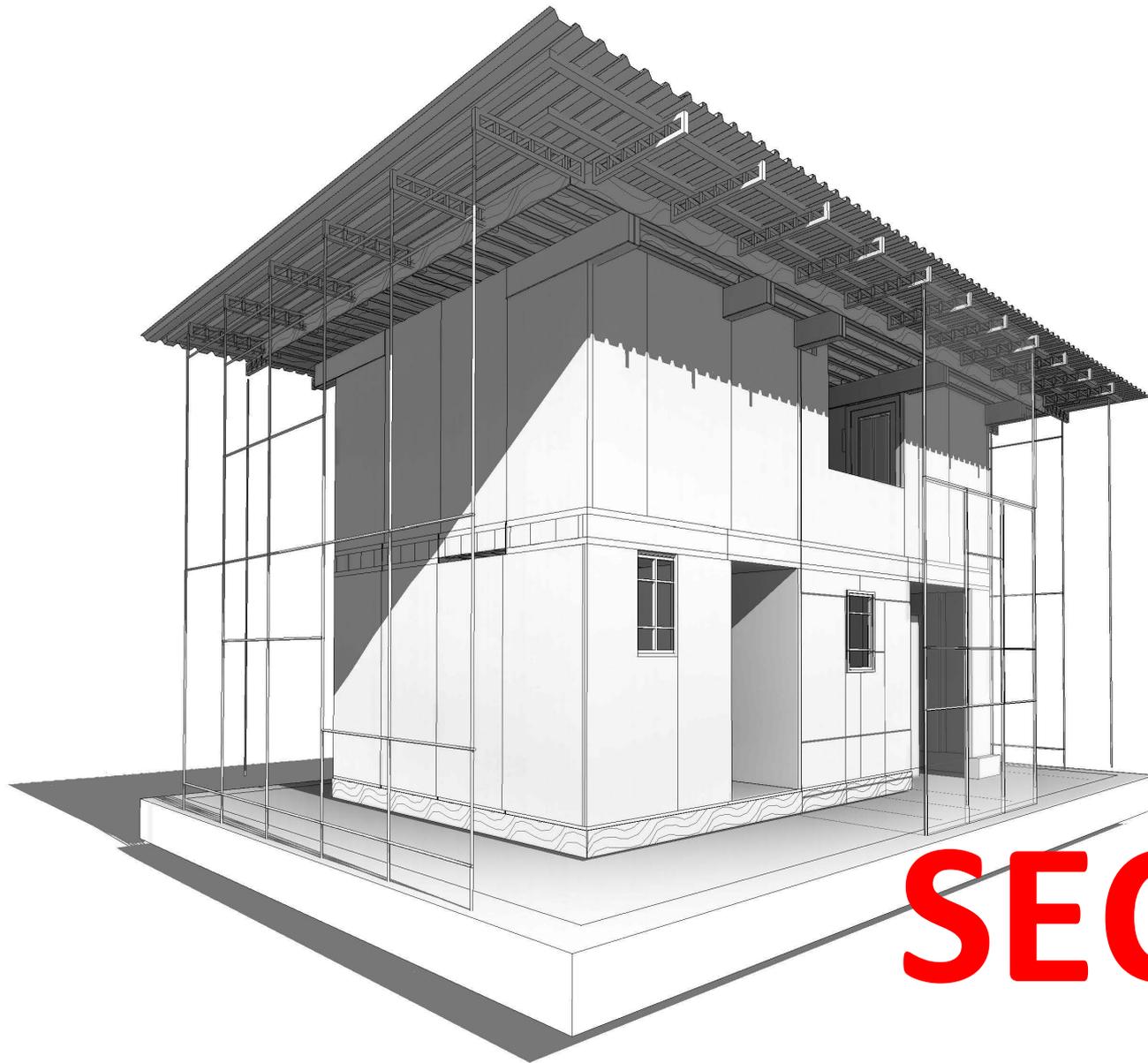
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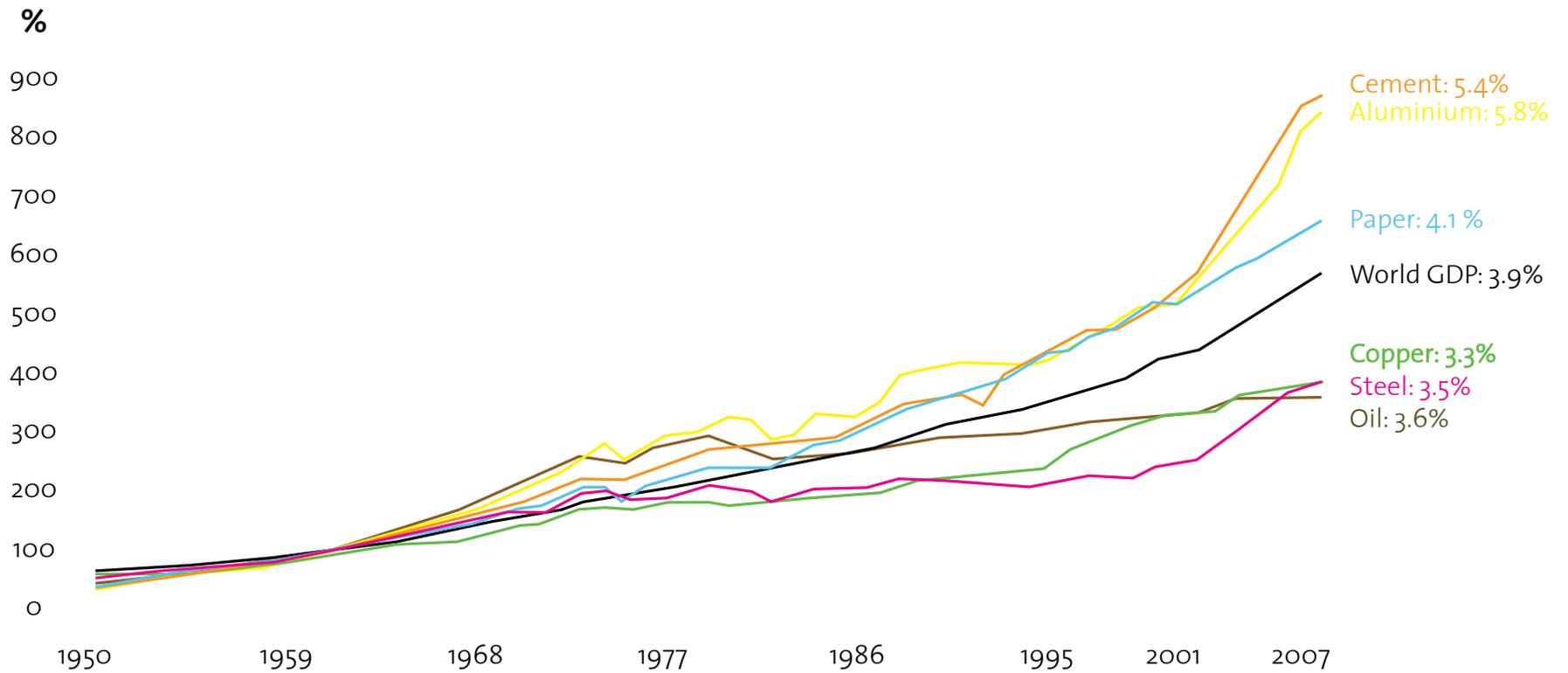
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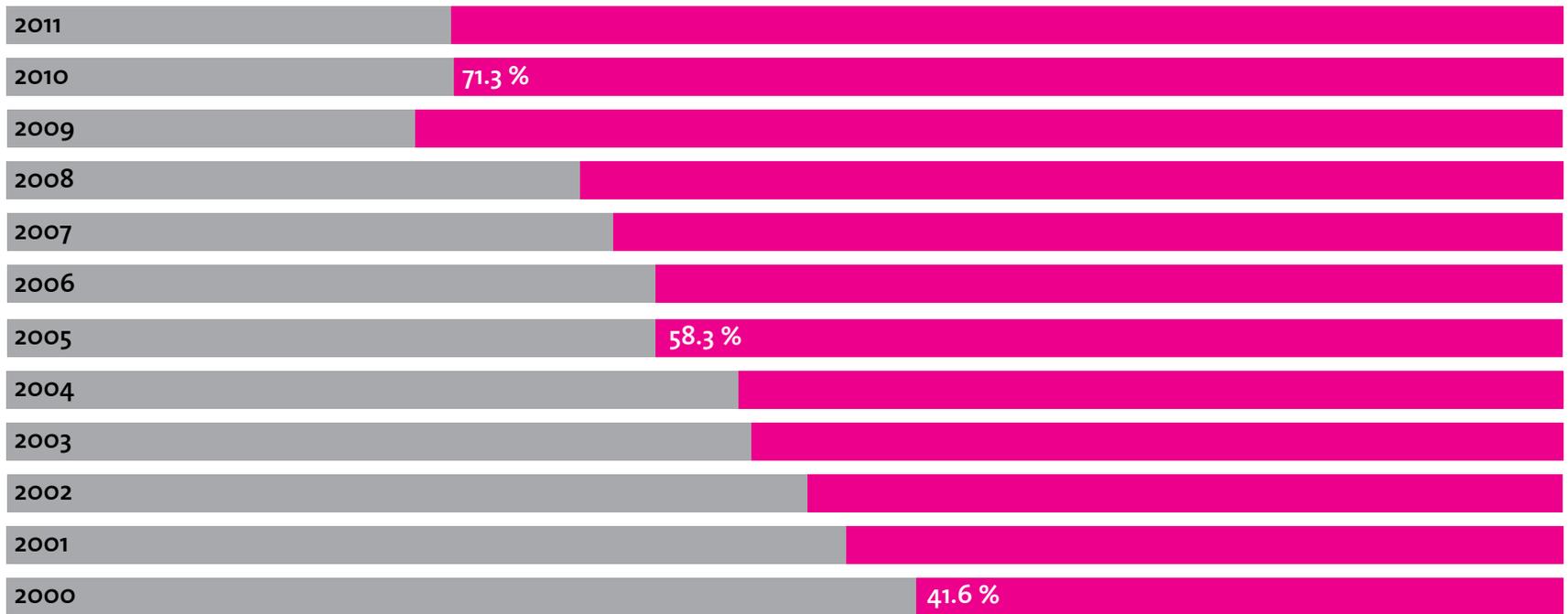
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Basic Materials Consumption World

Maddison database, BP, US Geological Survey, ICR, Cembureau 2011

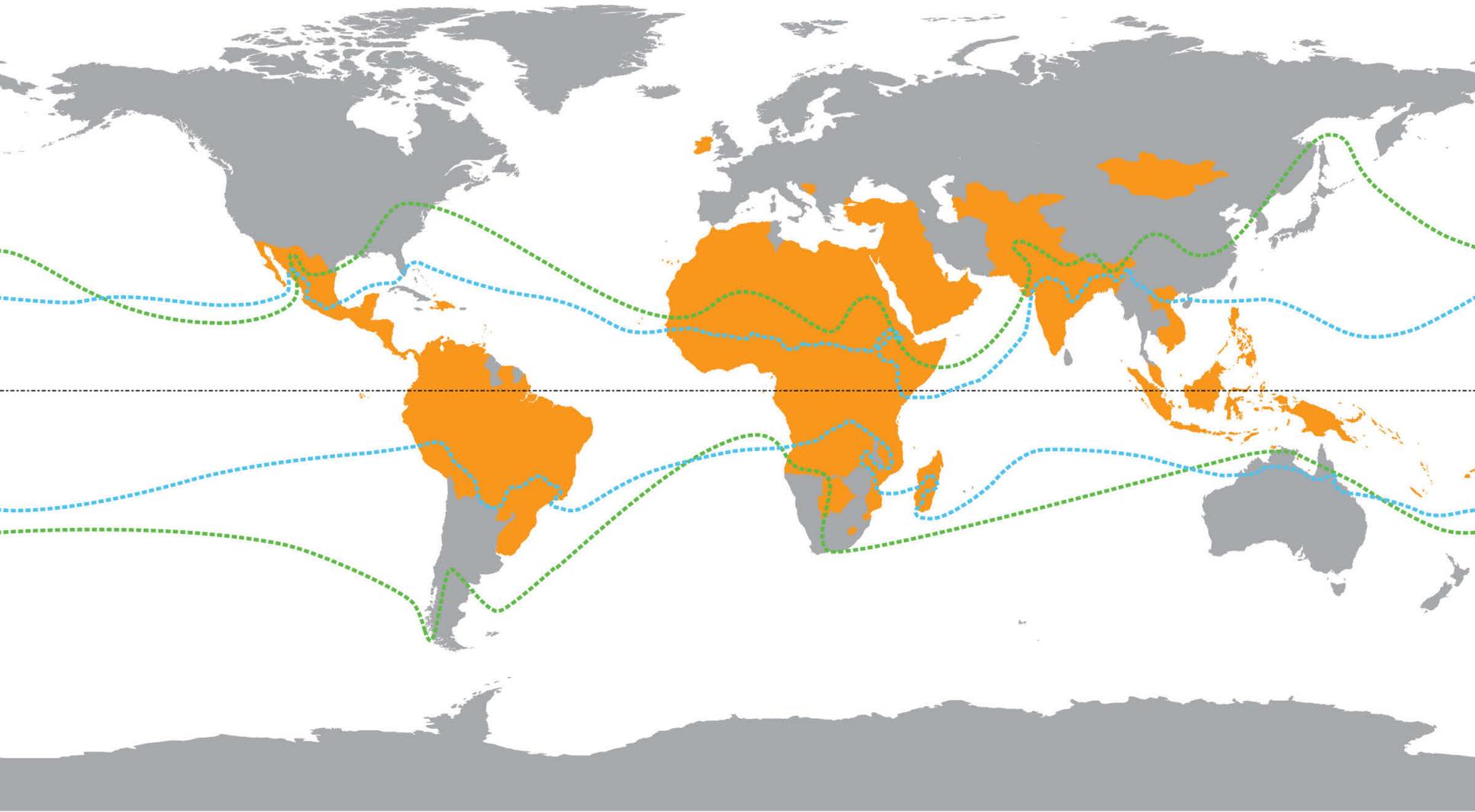


Developed Countries

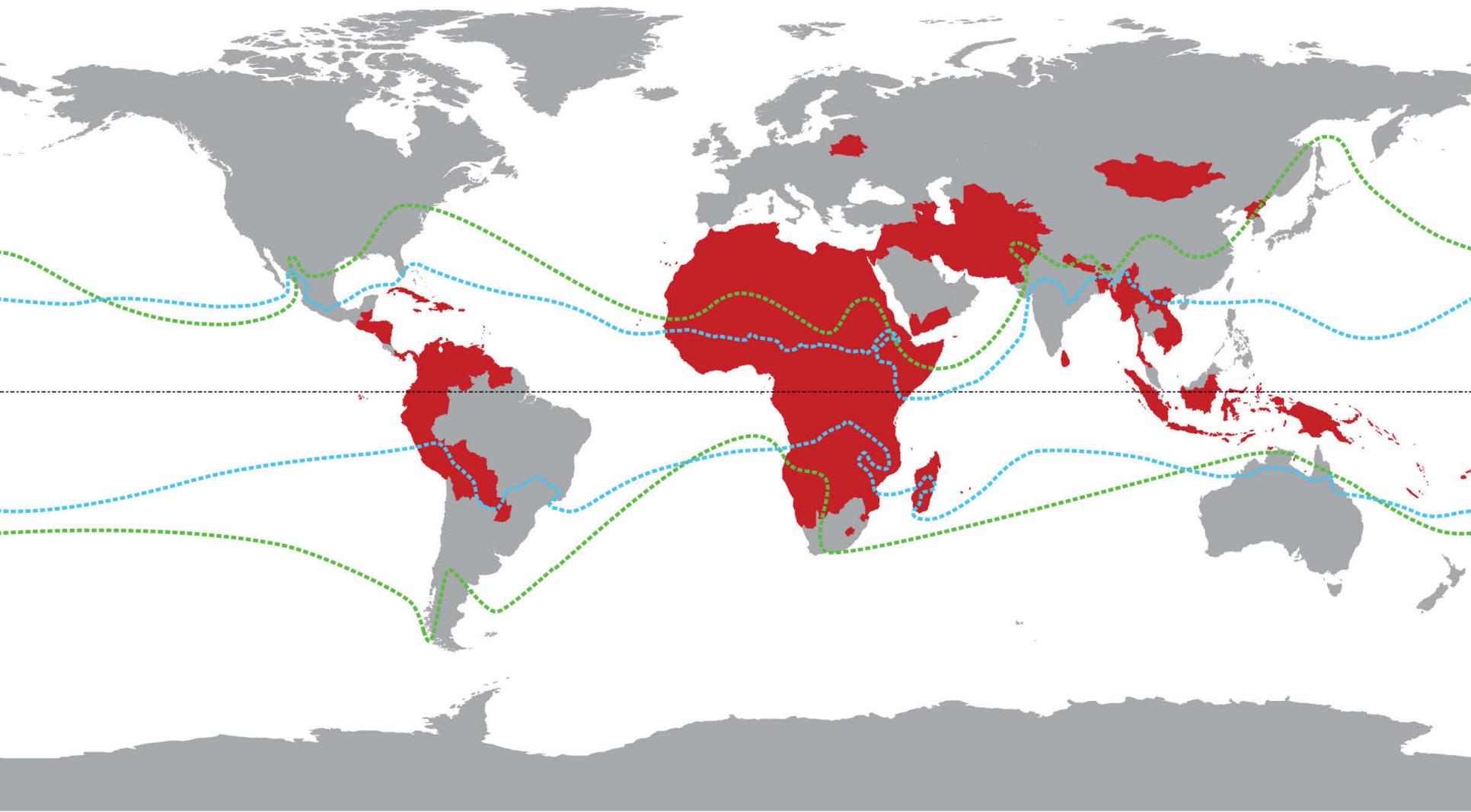
Emerging & Developing Countries

Regional Share in World Steel Demand

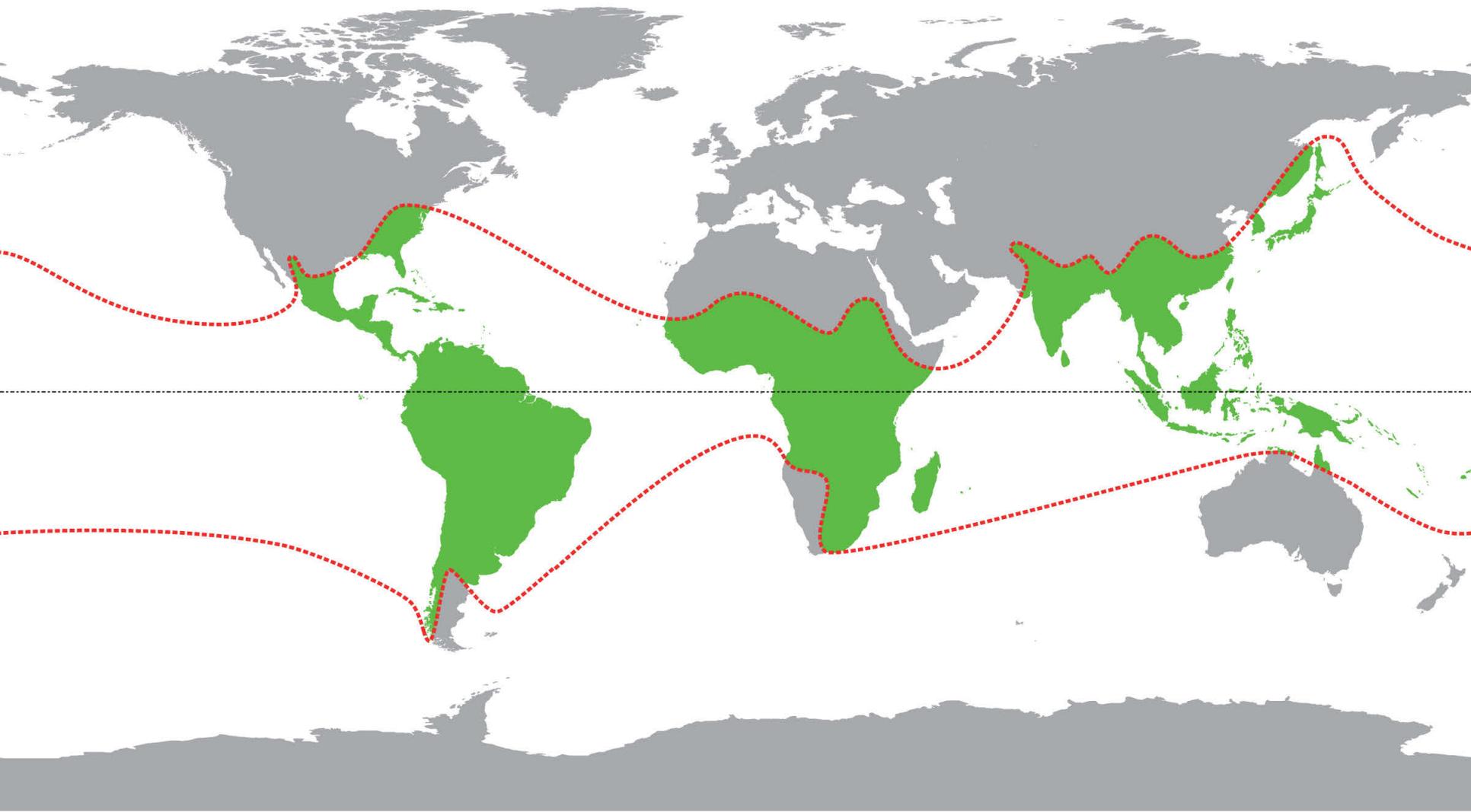
World Steel (2012)



Population Growth
countries with a population growth above 1%
US Census (2007)



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excluding NIC (Newly Industrialized Countries) and EMGP (Emerging Markets Global Players)
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Global Natural Bamboo Habitat

National Geographic (1980)

Bamboo

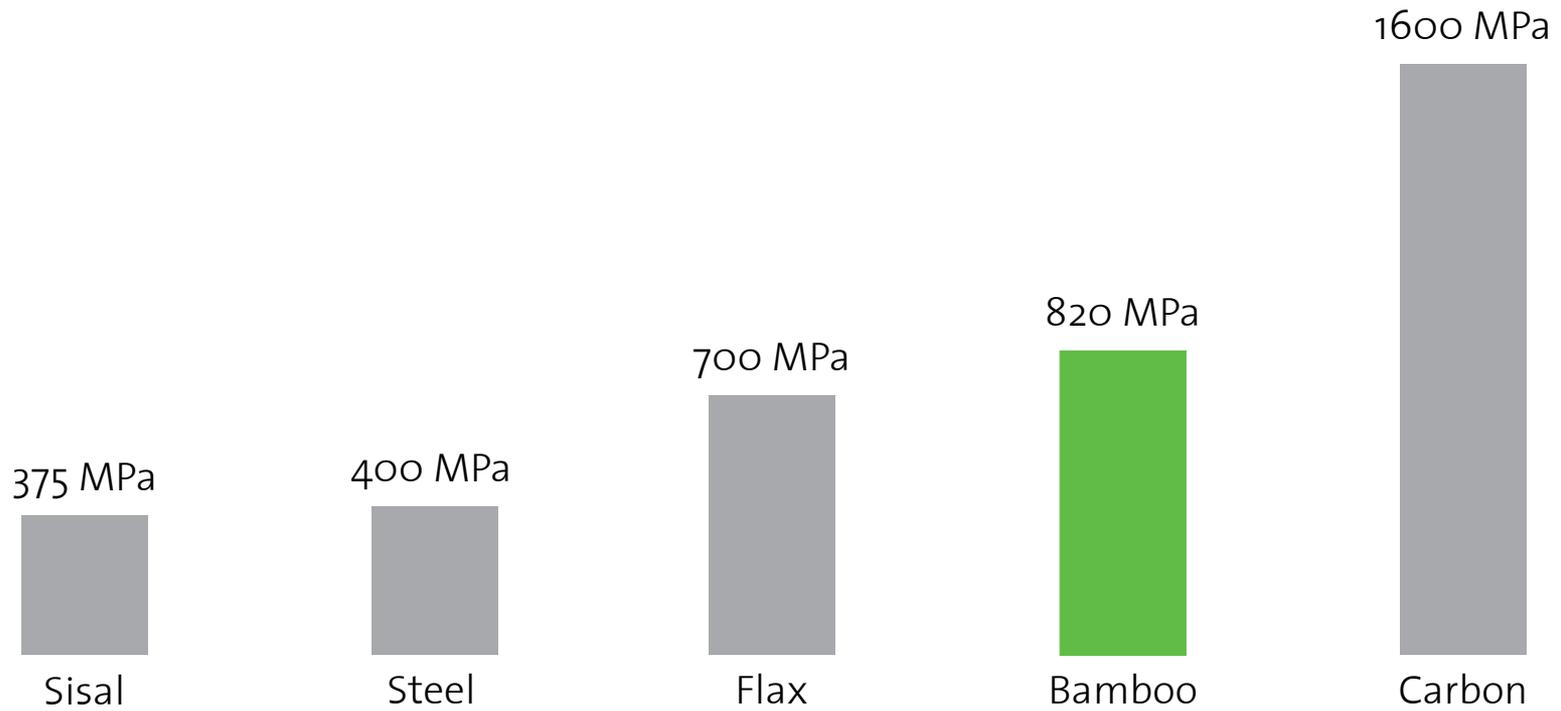
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Strength (MPa)
 Comparison with other fibres
 cmg composite materials group (2012)



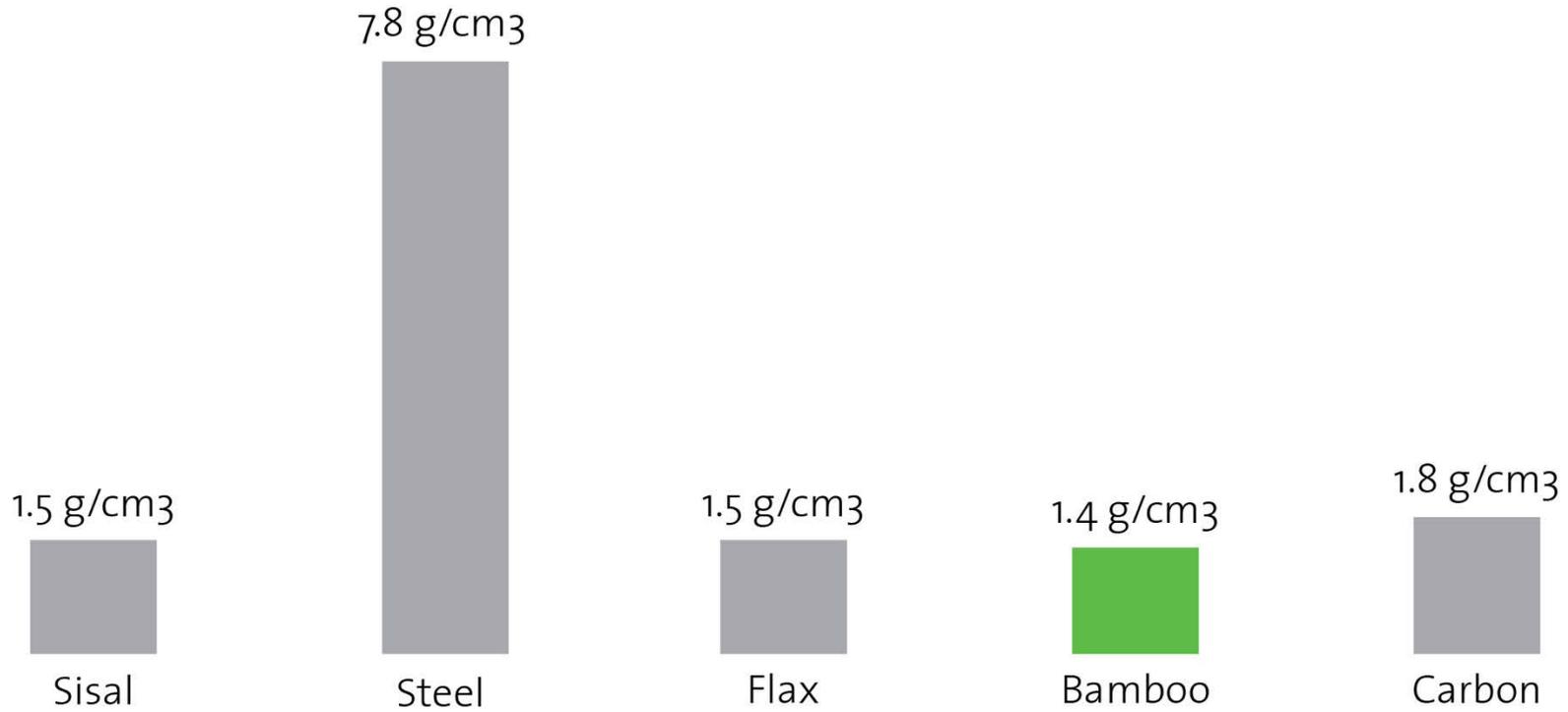
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Density (g/cm³)
 Comparison with other fibres
 cmg Leuven / Wikipedia (2012)



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Is this a new idea?

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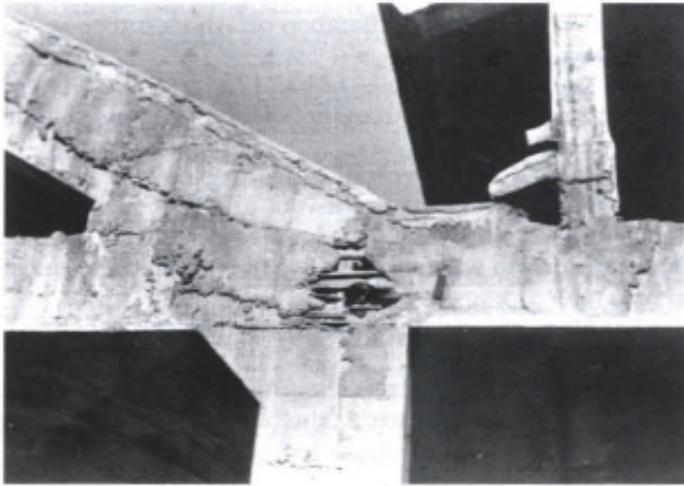
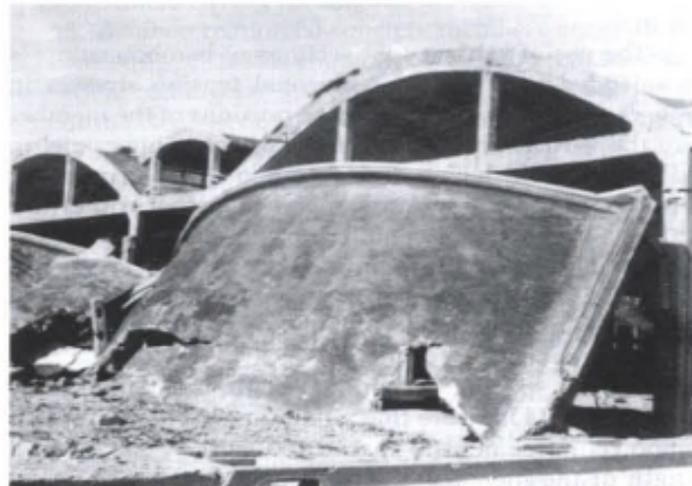


Fig. 13.16 A. *The bamboo reinforcement of the vault was exposed and according to the shadows there is not adherence between the concrete and the bamboo reinforcement.*



B. *The collapse of one section of the building. There was probably an expansion joint between the two sections.*

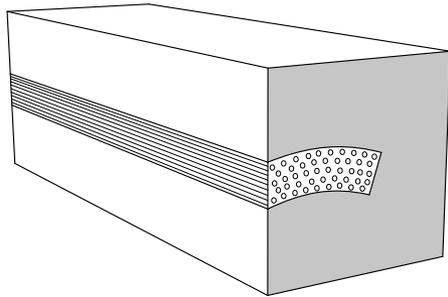


C. *There was a lack of adherence between the concrete and the bamboo reinforcement*

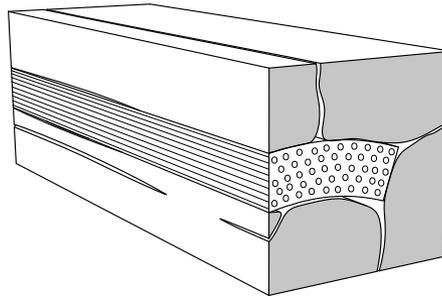


D. *The Bamboo reinforcement of the column broke.*

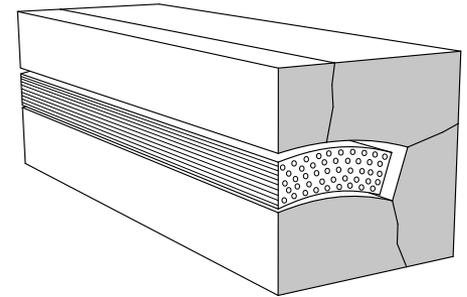
KO. Hidalgo - Lopez / Bamboo – The Gift of the Gods (2003)



1. natural bamboo in fresh concrete



2. cracks caused by swelling of bamboo



3. dried bamboo in expanded voids
debonded from concrete mix

Effects of swelling of untreated natural bamboo used as reinforcement in concrete



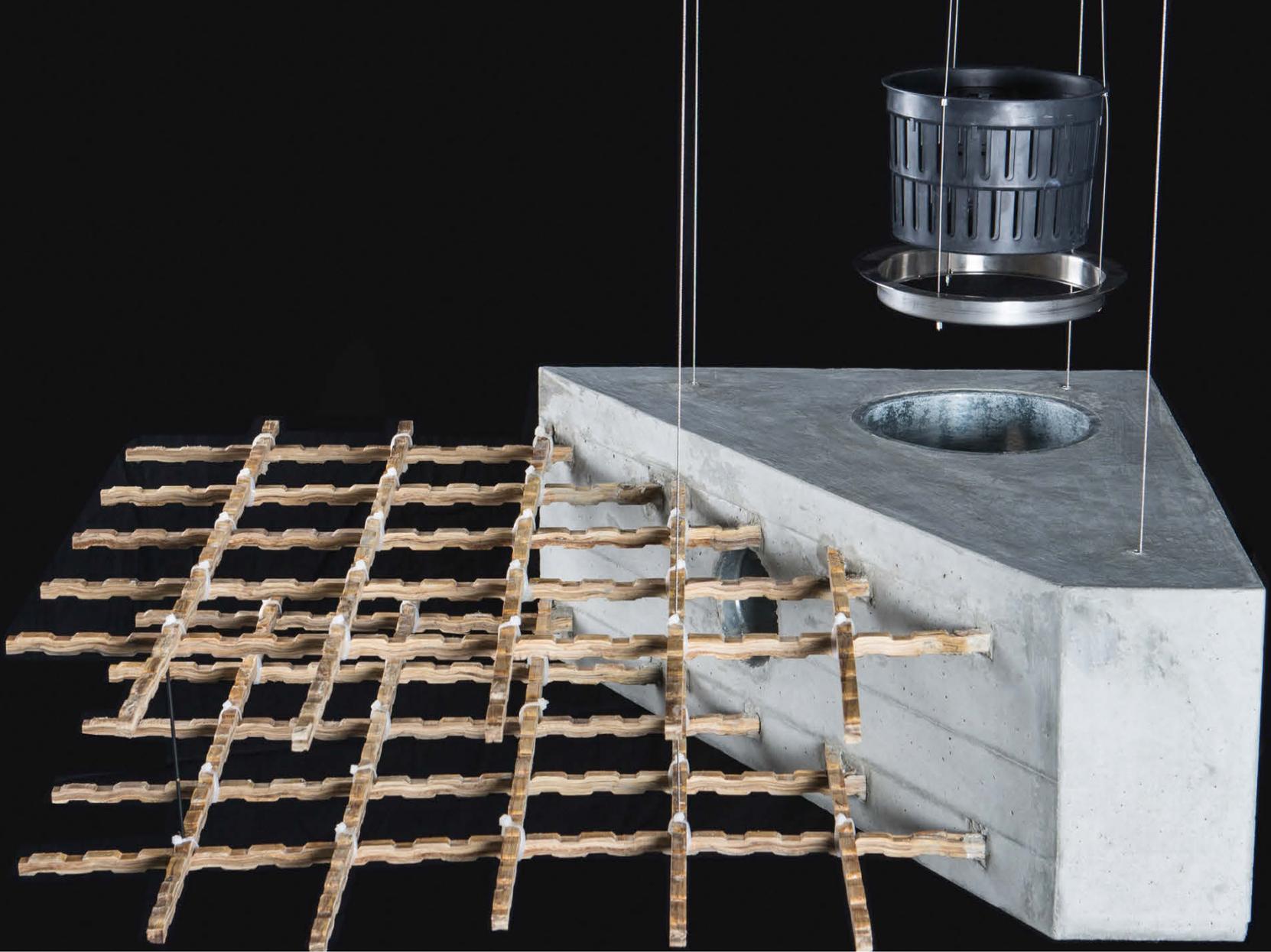
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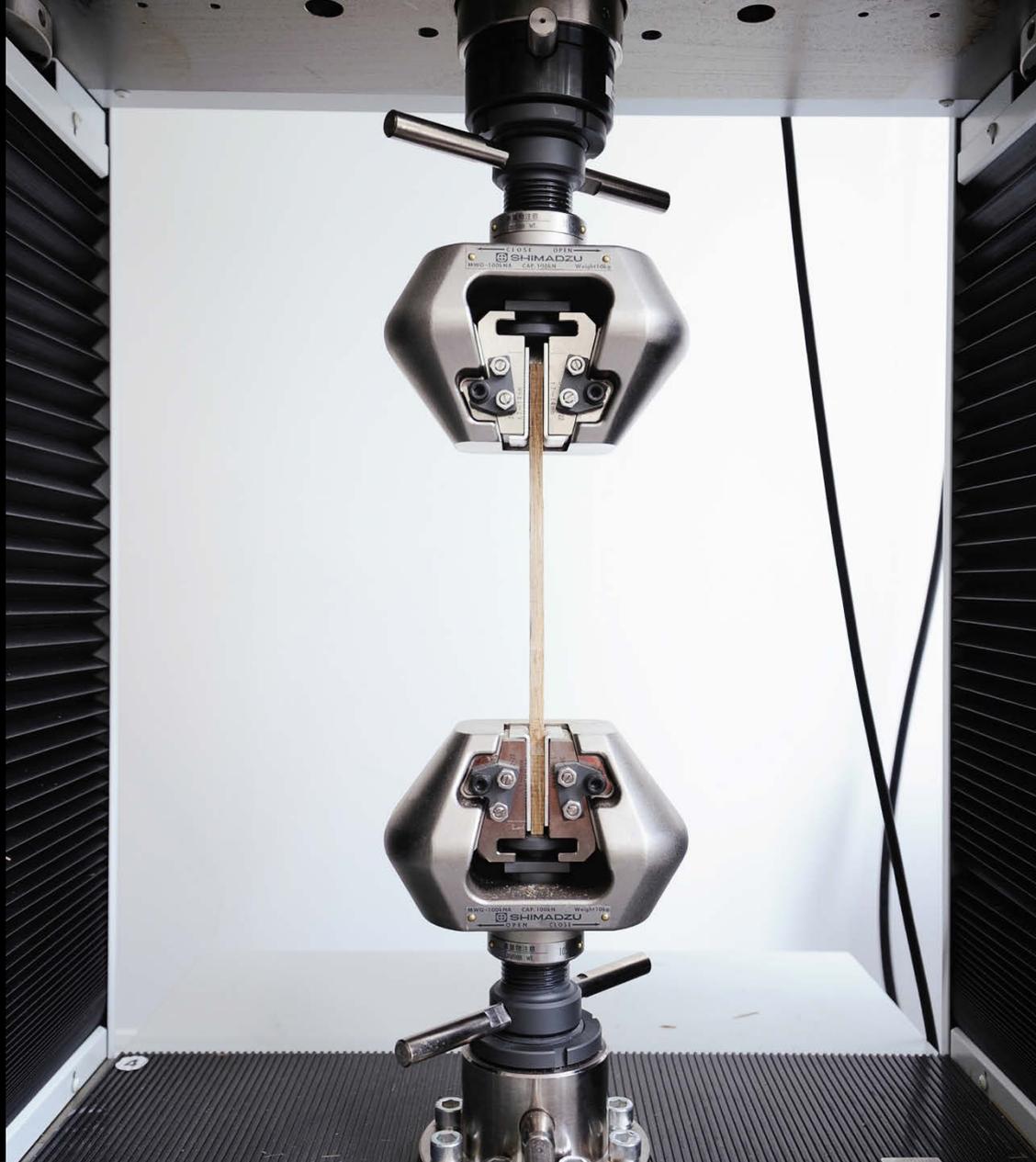
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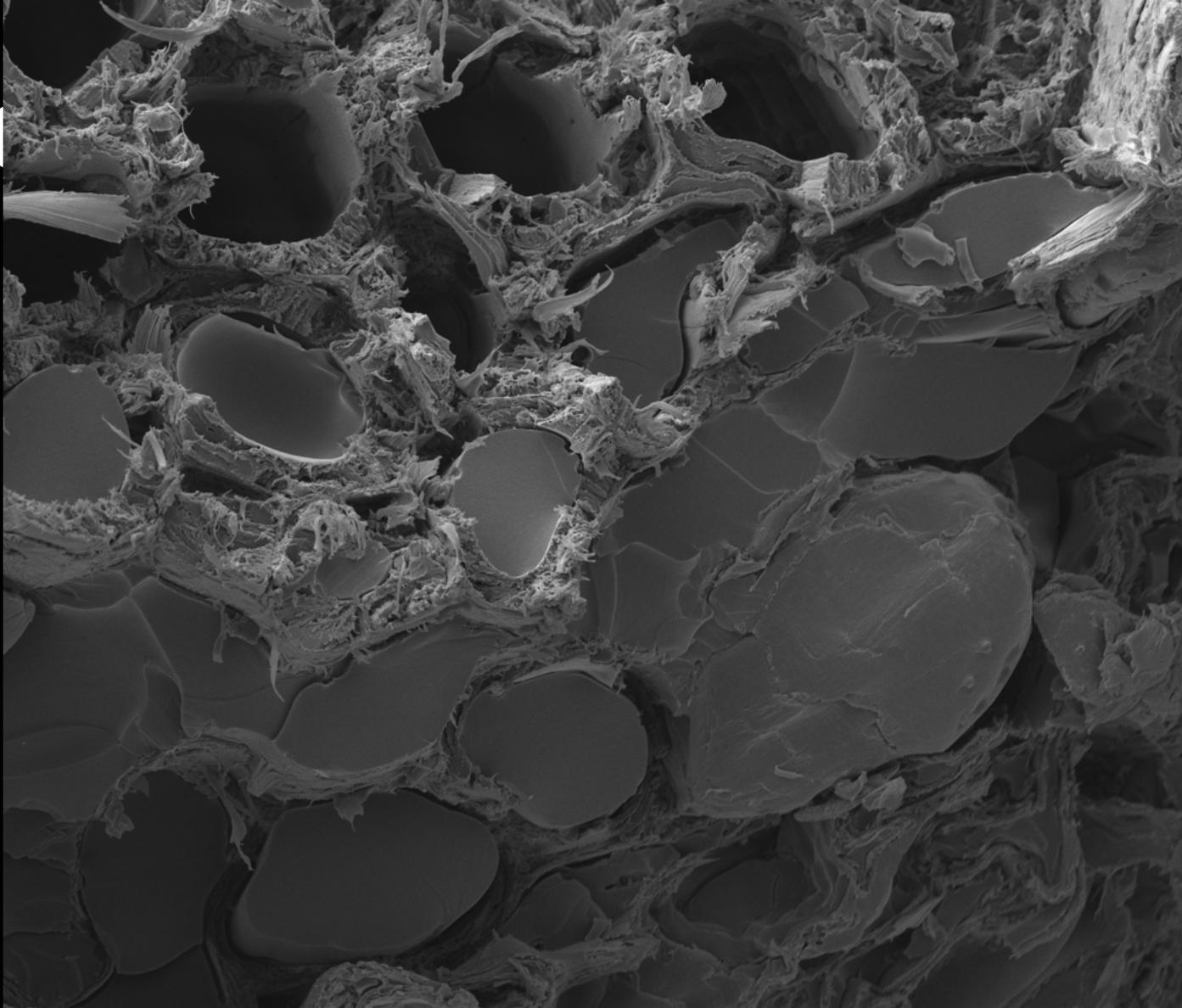
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cut



det	HV	mag	WD
ETD	5.00 kV	2 500 x	7.1 mm

50 μ m



Beni Composite G30
28/01/14
SEC - AFCL

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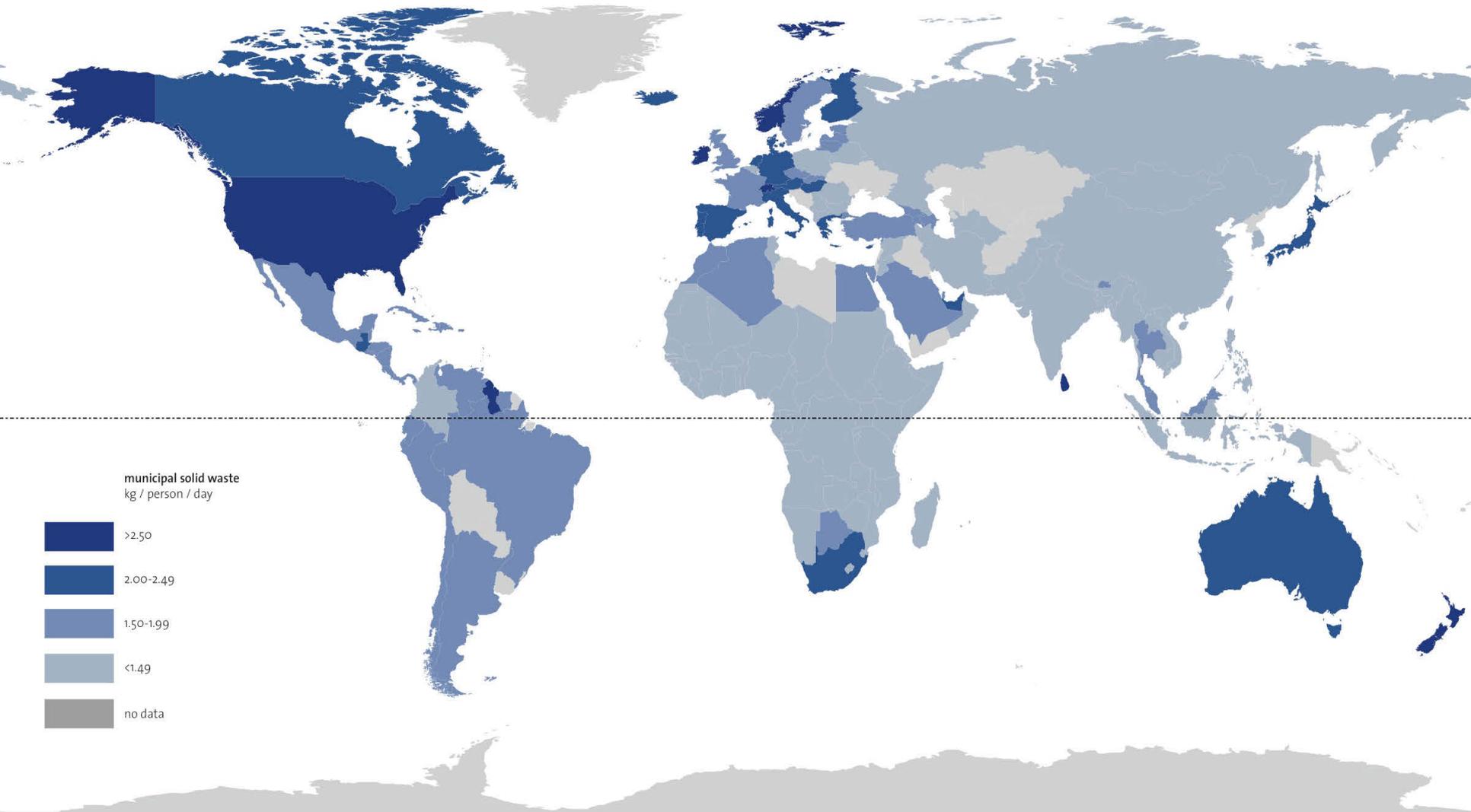
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Source: World Bank

BIRKHÜSER

Dirk E. Hebel
Marta H. Wisniewska
Felix Heisel

BUILDING FROM WASTE

RECOVERED MATERIALS
IN ARCHITECTURE
AND CONSTRUCTION

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NewspaperWood, Mieke Meijer with Vij5, Eindhoven, The Netherlands



NewspaperWood, Mieke Meijer with Vij5, Eindhoven, The Netherlands

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Ecovative, Green Island, NY, USA

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Ecovative, Green Island, NY, USA



Ecovative, Green Island, NY, USA with The Living, NY, USA



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an investigative documentary by Denis Delestrac



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