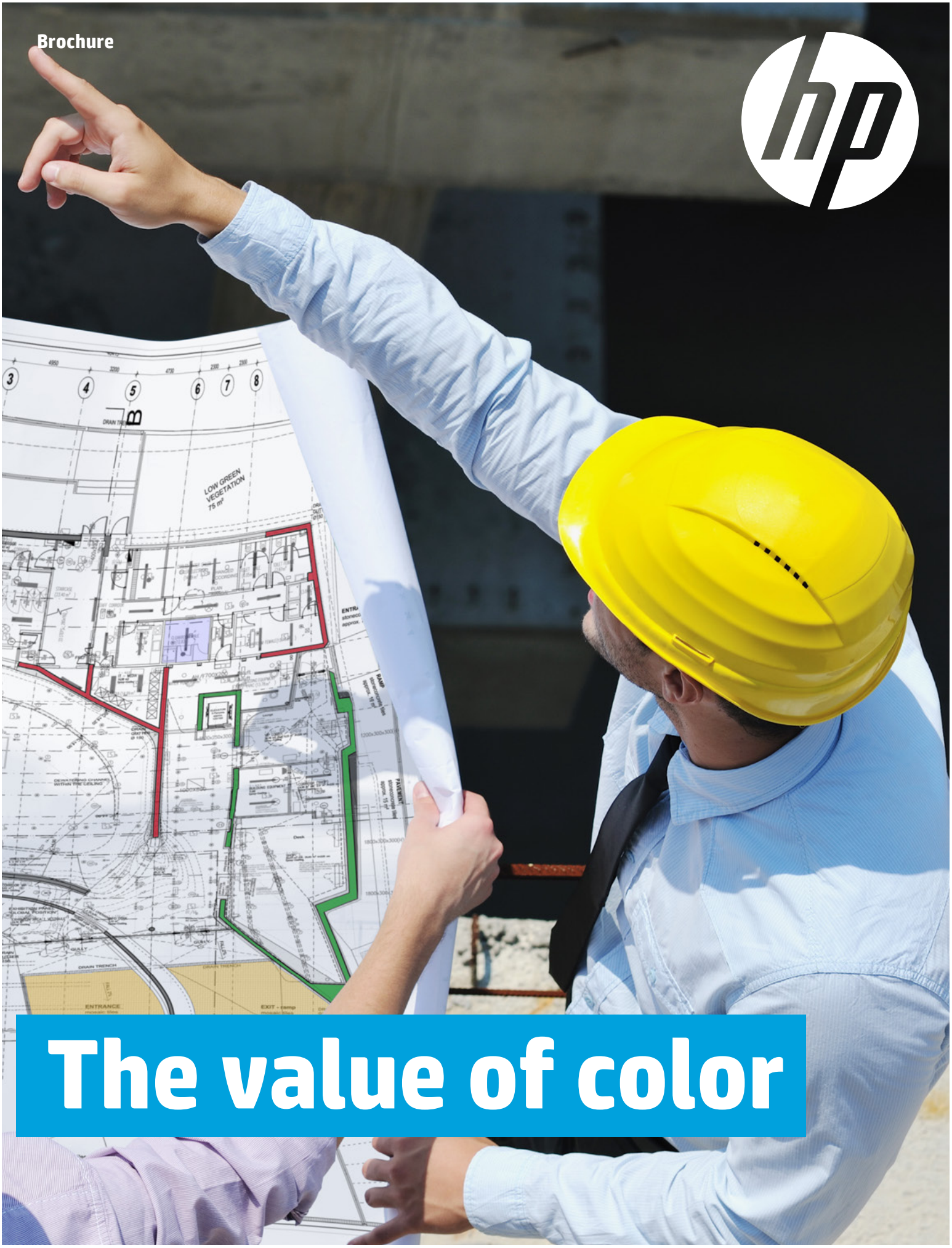
Brochure



The value of color

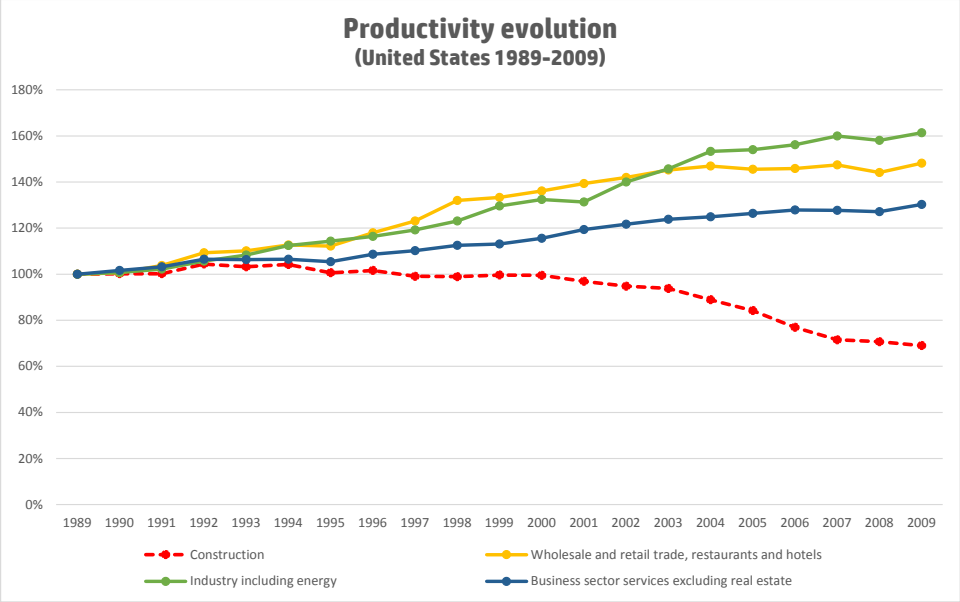
Rethinking productivity

Productivity in the construction business

Low productivity has been a constant drumbeat in the construction industry, raising costs and adding risk and waste across project lifecycles. Industry leaders are looking for ways to drive risk and waste out of their own project-delivery processes, and they see many opportunities for improvement across the range of engagements.

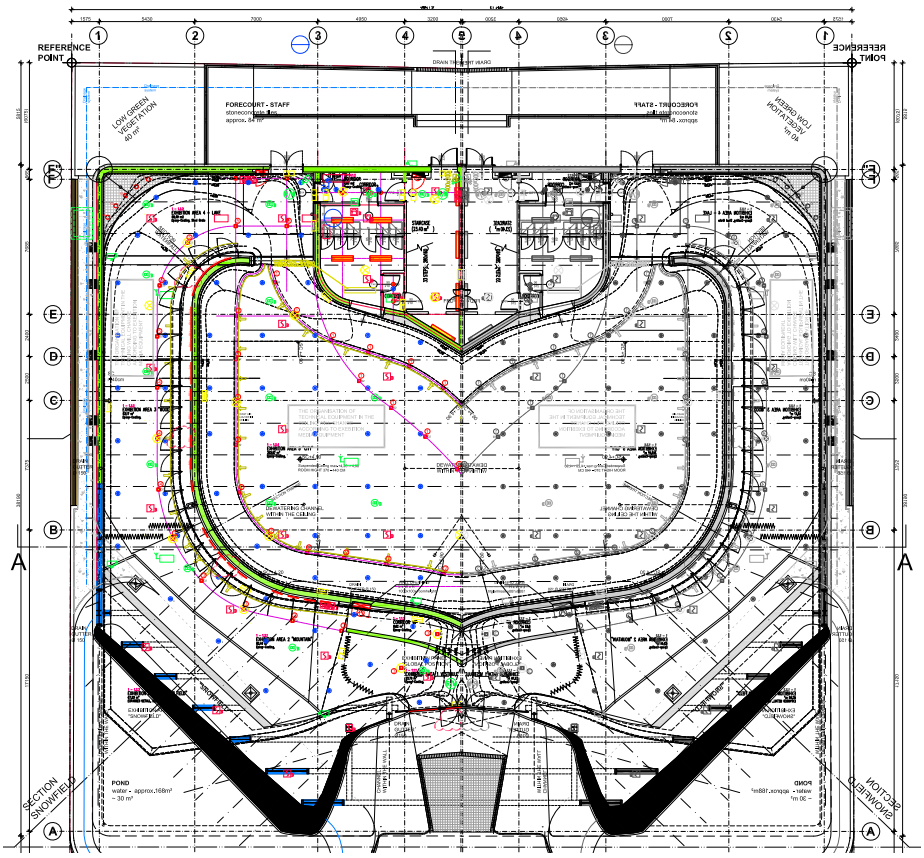
Based on The Economist, "Rethinking productivity across the construction industry: The challenge of change," (2015), a survey revealed that:

- **74%** of construction professionals surveyed indicate that lagging productivity is a major challenge
- **48%** believe that their firms have failed to come up with a coherent strategy to address this problem
- **32%** cite poor communication and collaboration as one of the leading obstacles to partner-related productivity, underscoring the need for better partnership models between contractors, clients, and investors



Construction Labor Productivity
Source: OECD Stats report. "Annual Accumulated % Growth of Multi-factor Productivity from Selected Industries, 2009.

Errors and waste are common in the industry



Waste is costly

According to the Lyra Research Inc. article “Color Construction Documents: A Simple Way to Reduce Costs, general industry estimates that between **10 and 30 % of all building** project costs can be attributed to wasted activities, such as schedule overruns due to inaccurate coordination scheduling, wasted labor and management time, wasted materials, and unnecessary litigation.

Based on U.S. Department of Commerce building estimates for 2009, a **10 % waste** factor is equal to approximately **$94 billion**.”

Unforced human error results in consequences

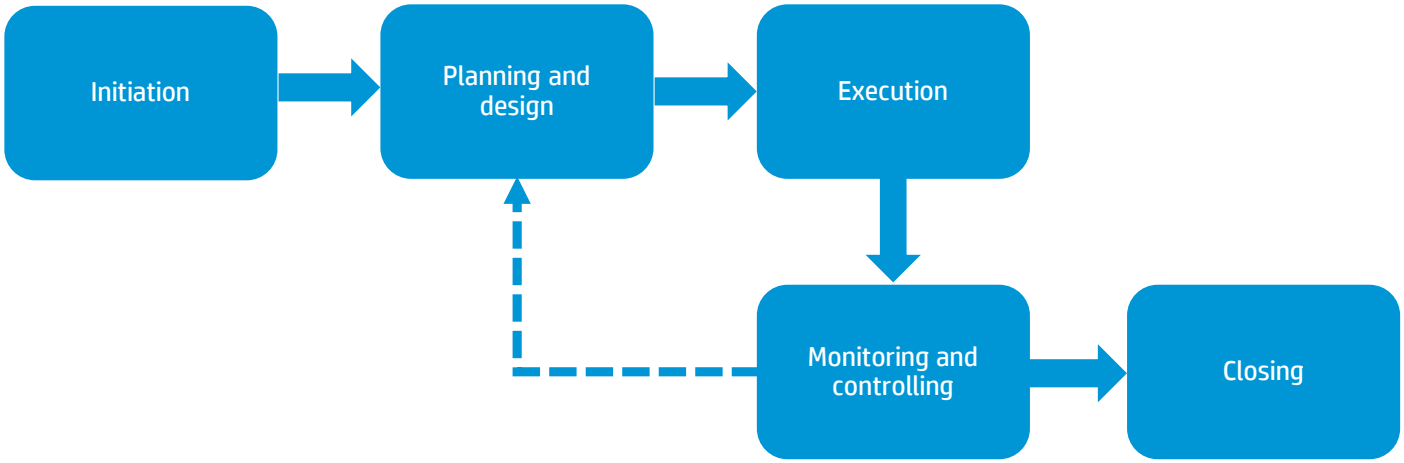
- Wasted material when building
- Wasted operator time
- Wasted time for manager to make corrections
- Time delay of the project due to the error
- Reprint of the plot with the corrections
- Litigation with the project lead

Studies suggest that between **70 and 90% of projects exceed the original planned cost**, and the overrun commonly reaches between **50 and 100% of the budget.**

21% of the time, poor exchange of information and communication causes errors at work.[1]

[1] According to GdC-Associazione Italiana Colore, “Color and Colorimetry Multidisciplinary Contributions,” 2012.

The AEC construction workflow: tasks and priorities



	Low-productivity consequences
Project owner	A major concern is closing the project on time with no extra costs. Any delay in the project delivery is most likely to result in extra costs.
Architect	Focused on transmitting attractive ideas and appealing designs when planning and designing. Providing misleading information can delay the entire project execution.
General contractor	A primary task is monitoring and controlling the implementation of the project. Any error when transmitting information can result in litigation, and additional costs and delays with the project owner.
Subcontractor	Subcontractors are focused on delivering on requests as quickly and accurately as possible, minimizing errors. Information errors can result in rework and time delays and penalties from the general contractor.

AEC industry trends

Building information modeling (BIM)

BIM is an integrated process that allows professionals to explore a project's key physical and functional characteristics digitally before it is built.

Integrated project delivery (IPD)

IPD is the alliance and collaboration of all agents of a project. The benefit of this delivery method is that it spreads the risk equally among all parties involved in the build. All parties are focused on a common bottom line which means increased pressure to maintain accuracy and manage waste.

Mobility

With the technology currently available, more time is spent on the road and the use of smart phones and tablets is ubiquitous. Documents are stored using cloud services, and companies must frequently access and print drawings from anywhere. Plans and documents require accuracy and constant corrections from different locations.

The need to differentiate

Public investment has declined since 2008 while competition has increased. With more competition in the market, it's more difficult to win bids. From the bidding process to delivering the final construction documents, improvement is needed in all areas to address the competitive environment.

The advantages of printing in color

Color printing has become an important component in projects because it can decrease human error rates. It has been proven that color documents are more easily understood and the information is retained at higher rates versus monochrome documents.[2]

The use of color documents reduces errors and allows a team to easily understand the sections of a plan for which they are responsible. During the bidding phase, color documents make a more professional impression than monochrome documents.

Throughout the project, the use of color in documents can help keep the project on time and on budget.

Color is effective:

By the numbers

In up to **65%** of the cases, color documents are more easily understood and the information is retained at higher rates versus monochrome documents[3]

Up to **80%** errors reduction due to the use of color documents[3]

Color drafts reduce failure cost on building site by **3.9%**[4]

Around **0.25%** of the costs of the project[5] are typically construction documentation costs

$1 invested in color printing can yield **$4** in savings for a given project[5]

[2] According to "Why Color Matters," by Jill Morton, 2010.

[3] According to "Color For Impact," by Jan V. White, 1996.

[4] According to InfoTrends/CAP Ventures, "Visual architecture and interactive design for AEC industry: state-of-the-art about the impact of color on B.I.M. workflow," GdC-Associazione Italiana Colore, 2012.

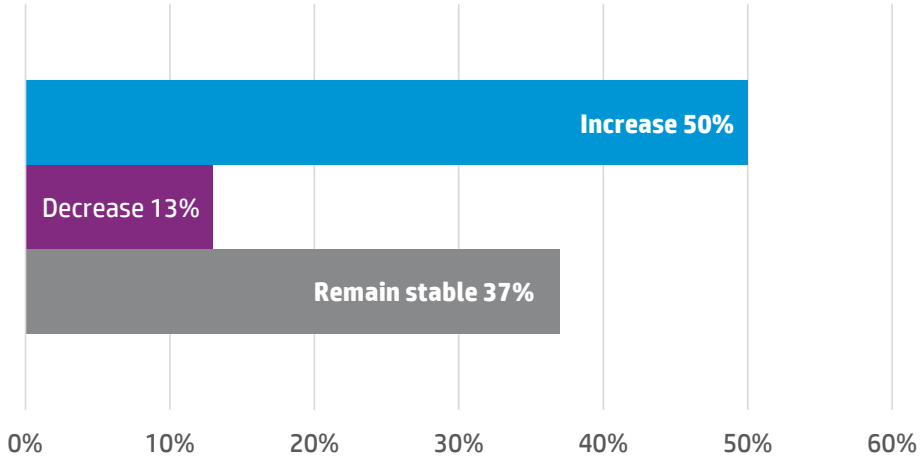
[5] According to Lyra Research Inc., "Color Construction Documents: A Simple Way to Reduce Costs," April 2010.

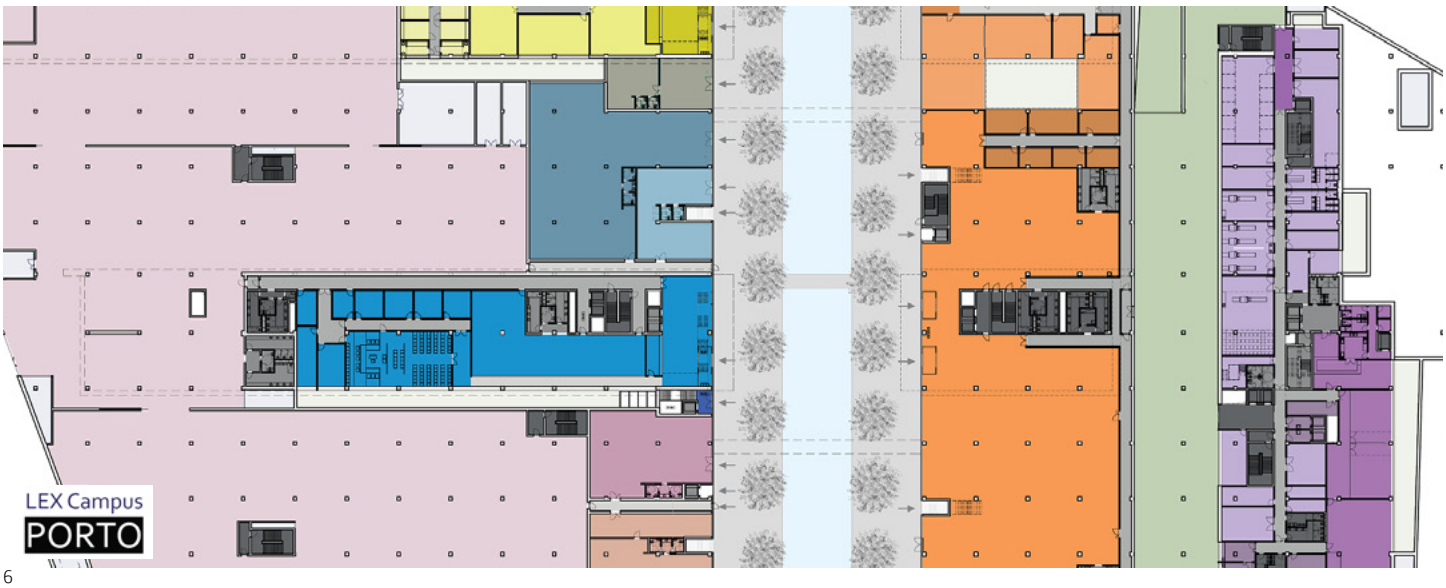
Help save time and money—print in color!

	Impact of printing in color	Benefit
1	Better understanding when reading files with multiple lines	Faster reading More time efficiency
2	Reduce human error when interpreting line drawings, avoiding potentially large extra costs in project delivery	Save time and money
3	Avoid manual stamp work for Certified/ Stamped plots	Reduce delivery time
4	Copy corrected mark-up files that could not be printed before	Better communication

Color adoption is increasing

What do you expect in terms of color adoption in your company in the next year? InfoTrends, 2014 LED market research found:





Now you can see a high return on your investment—print in color!

$1 invested in color printing can yield $4 in savings for a given project[6]

The following example demonstrates the potential return on investment (ROI) of printing in color compared to printing in monochrome.

ROI example

	Value	Percentage	Source
Original project budget	$ 7,000,000	70%	*The Economist, 2015*
Extra cost due to errors	$ 3,000,000	30%	
Total cost of the project	$ 10,000,000	100%	*Lyra Inc., 2010*
Investment in printing	$ 25,000	0.25%	
Extra investment in color printing	$ 25,000	0.25%	*Info Trends/CAP Ventures, 2014*
Savings from reduction in errors as a result of printing in color	$ 117,000	3.90%	
Net benefit/savings from printing in color	**$ 92,000**		
Return on investment	**3.7**		

[6] According to Lyra Research Inc., "Color Construction Documents: A Simple Way to Reduce Costs," April 2010.

Summary

Here's what customers have to say:[7]

"Working with color printouts is easy. We need less prints when in color, both for the client and internal use."

"We would use more color printing. Clients visualize 3D easier in color."

"The drawings are getting more and more complicated because we don't draw by hand anymore, we use ArchiCAD and more and more plans will, therefore, have to be in color as they are impossible to read otherwise and everything has its own color—like all electrical things are yellow, all waterpipes are blue and so on."

"It will be easier and faster. I will have better definition and simpler drawings using color."

"Imagine a drawing of a house which is going to be altered. Color drawings can give everyone their own color—for instance, the builder is green and he knows that all green lines refer to him, and the electrician is yellow and he can pick out his lines as well. That means I don't have to do several drawings for different people and they can all see the complete picture and pick."

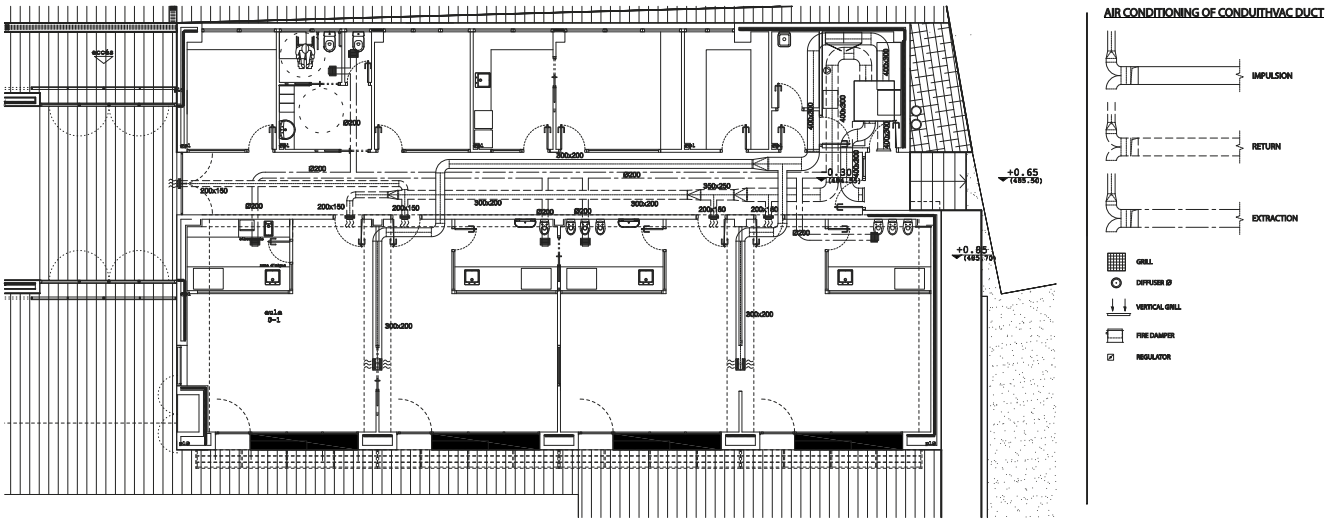
Monochrome	Color
Monochrome can require reprints due to misleading information **Extra costs**	Color helps avoid errors **Save money**
From the same BIM file from the architect, different plots need to be generated in order to generate all the information required **Extra work**	A wide range of information can be represented in a single plot **Print less**
It is difficult to distinguish and read information when all printed in monochrome **Generates errors**	Color transmits exactly what the designer wants to communicate **Improve efficiency, on-time delivery**
Monochrome prints do not differentiate information which can lead to duplicate work **Miscommunication**	Color highlights corrections, priorities, concerns, and warnings **Improve communication**

[7] Quotes extracted from HP internal market research.

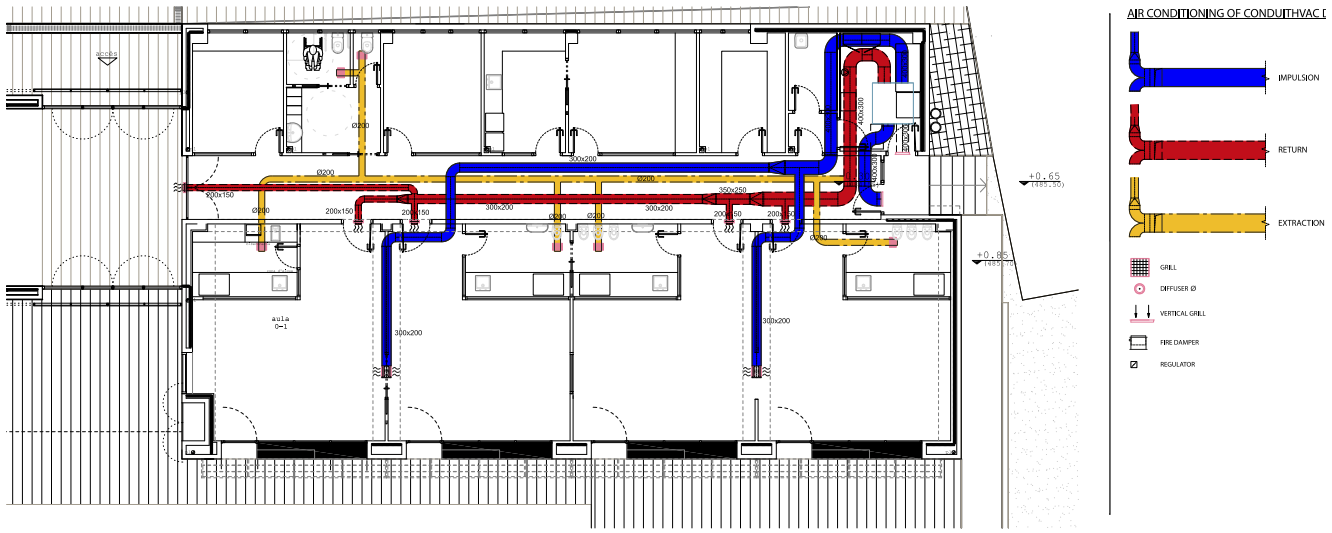
The value of color

Practical example in a “VENTILATION plane”

VENTILATION

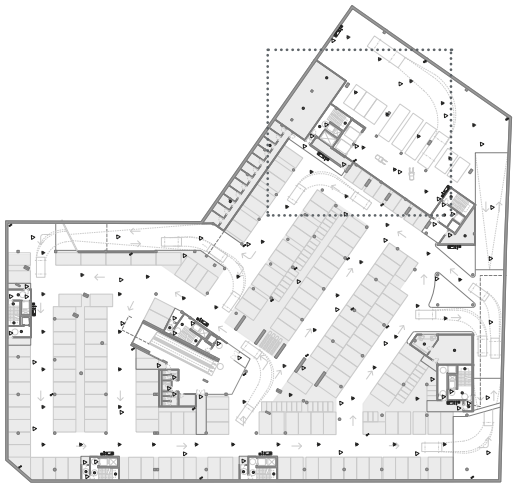


VENTILATION



The value of color

Practical example in a “FIRE ALARM plane”



FIRE EXTINGUISHERS (21A-113B) located at a distance greater than 15 meters from any emergency exit, facing the direction of the evacuation path. CO2 Extinguishers located near important electrical equipment.

EMERGENCY LIGHTS in all emergency exits guaranteeing minimum illumination of 1 lx at floor level and 5 lx when placed close to safety equipment and electrical panels.

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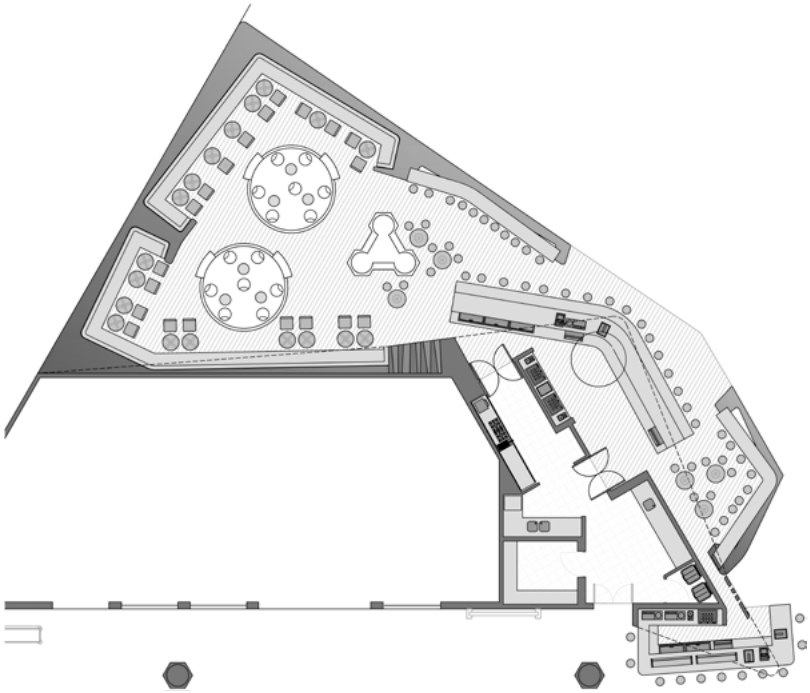
The value of color

Practical example in a “ARCHITECTURAL plane”



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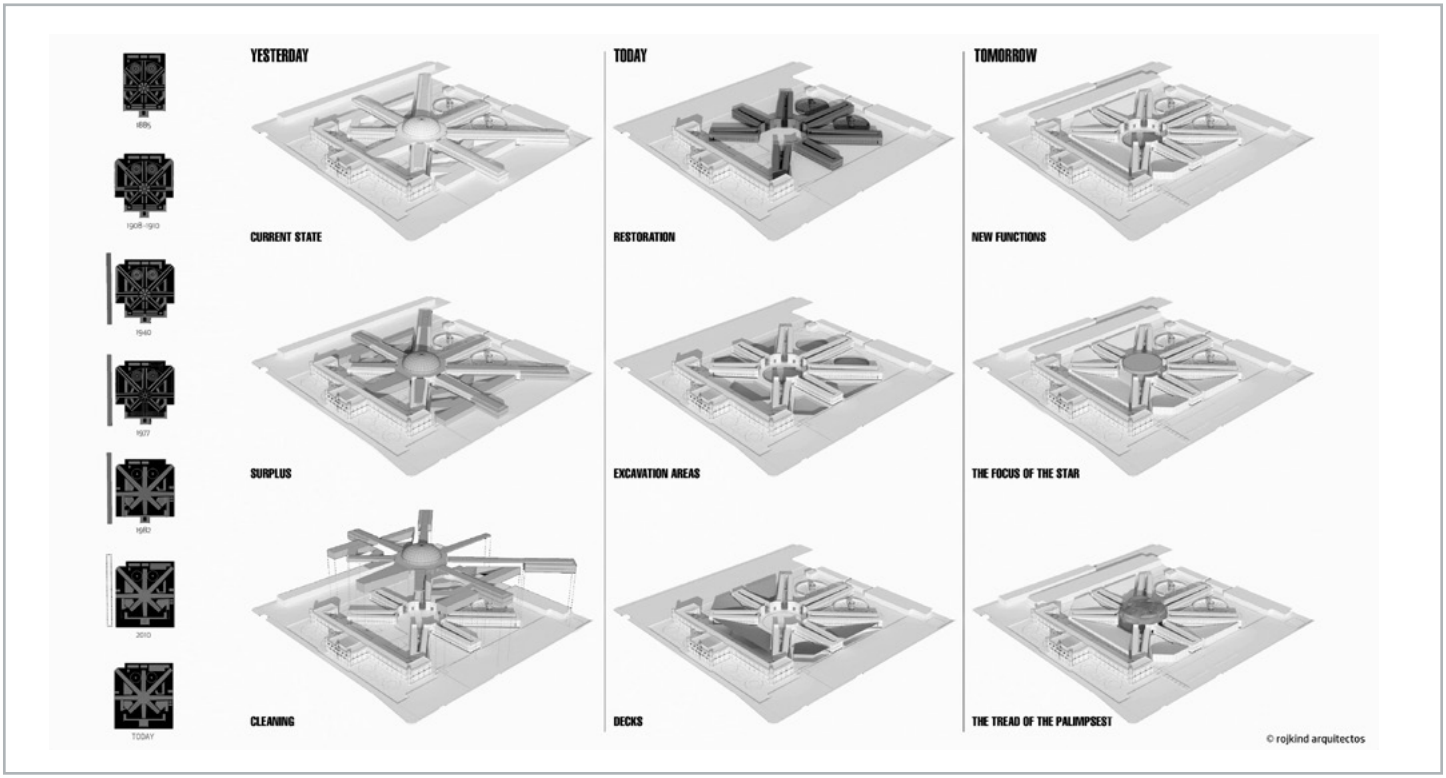
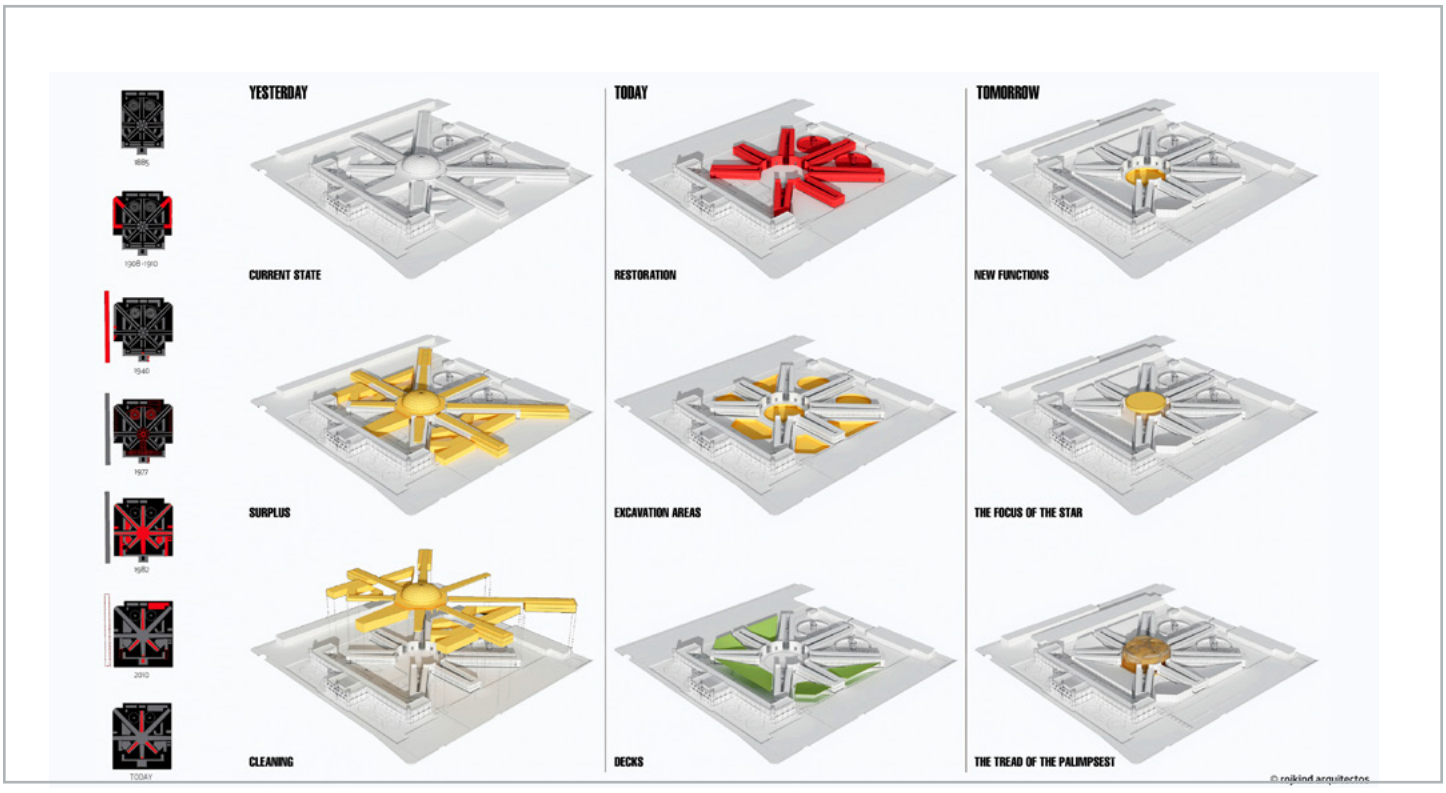
Practical example in a “3D RENDER plane”





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