Paper No: 342 : Aesthetic vision and sustainability in The New York Times Building ceramic rod facade

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Abstract

This study investigates the implications of the New York Times Building aesthetic vision in respect to its sustainability goals; namely: to enhance the NYT work environment through the effective management of daylight, offsetting the building's lighting and cooling energy demands. The study focuses on the role of the ceramic rod façade and concentrates on its implications on the building's energy demands. The study makes a case for aesthetics informing the building's sustainability goals and pushing for innovative solutions to sustainable architecture.

Keywords: aesthetic vision; sustainability goals; innovation

1. Introduction

Can aesthetic vision inform sustainability goals in architecture? This paper investigates the design of the New York Times Building (NYTB) (Fig.1), opened to the public and occupied by the owner in November 2007. The study focuses on the NYTB ceramic rod façade (CRF), considered the key element linking the building's aesthetic vision to its sustainability goal; namely: the effective management of daylight to improve and enhance the quality of the New York Times (NYT) work environment. This sustainability goal has, at best, the double advantage of improving productivity and offsetting the energy demands for artificial lighting and cooling, typically the two main energy demands for high rise office spaces in NYC. While the NYTB awaits post occupancy evaluation, the study concentrates on the aesthetics and energy implications of the CRF, drawing from the CRF physical properties and predicted and empirical energy data.

The study begins by reviewing the NYTB design genesis. It then explores the building's guiding aesthetic vision and the function of the CRF. Finally, the study summarises and concludes on the design approach of the NYTB, with considerations on the integration of aesthetics and sustainability in architecture.

1.1 Building's description

The site of the NYTB building is between 40th and 41st Street and along 8th Avenue. It is surrounded by high-rise buildings to the east and south and is relatively open to the west and north. The volume of the building is divided in two main parts: i) a four storey podium and ii) the NYTB tower. The 1st floor of the podium contains public spaces, including an auditorium, restaurants and shops. The 2nd, 3rd and 4th levels of the podium are dedicated to the NYT newsroom. The tower proper is a 52 floor cruciform plan volume of approx. 59.1 x 47.8 m encumbrance, and is designed to maximise access of daylight and view. The thermal envelope of the office spaces is composed of a floor to ceiling ultra clear low-iron glass. Daylight entering the building is externally tempered by the array of ceramic rods (Fig.2), constituting the four external façades of the building, and internally controlled by a state-of-the-art motorized sun screen (Mechoshade) coupled with a dimmable electronic ballasts system, developed by Lawrence Berkeley National Laboratory. This system, it is important to state, was developed with the CRF configuration already set [10].

Fig 1. The NYTB during final construction phase. Feb 2007

The ceramic rod facades on all four orientations of the building are detached from the building thermal envelope by a 0.2 m gap. Each rod of the facade is composed of an aluminium silicate extrusion of off-white colour and measures 1.52m in length and 4.13 cm in diameter. The rods are mounted on 4.1 x 1.5m panels. The space between each rod varies: closely spaced at the spandrels and rod-free at eye level.

Fig 2. The NYTB ceramic rods

Architect: Renzo Piano Building Workshop, with FxFowle (Renzo Piano, design principal; Bruce Fowle, project principal).
Director of Construction: Glenn Hughes
Architect in charge: Serge Drouin (RPBW)
Engineers: Flack + Kurtz (m/e/p).
Environmental Energy Technology Division: Lawrence Berkeley National Laboratory.

2. The NYTB design genesis

The NYTB building originates from an international competition launched by the NYT in early 2000. The goal of the competition was to produce a design that would best reflect the company's image. The company desired a building that would communicate the transparency and intangible qualities of the NYT media world as well as establishing a visual connection with the public at large [12]. From a functional perspective, the primary goal was to create an environment that would enhance the way employees work, not a statement of green building design [8]. It was soon learned, however, that some sustainability strategies, and primarily the successful management of daylight, would improve creativity, productivity and visual connection [10]. Of the four short-listed projects, the proposal by Genoa based architect Renzo Piano was perceived to best reflect the company's needs. The building's guiding aesthetic vision, as stated by Piano, could be summarized as: transparency (of the NYT work production); lightness (the immateriality of the media world); and connection (with the city and the environment). [3, 9, 11]**.**

2.1 Piano's sketch

Piano's flagship sketch for the building (Fig. 3) is important in better understanding the forces that drive the NYTB design. An architectural sketch could be considered as the outcome of an intuitive process that, at best, encapsulates the many values and requirements of architecture. Piano refers to this intuition as 'a rapid process of synthesis, a turbocharged form of rational thinking' [13]. Piano's sketch shows the building's connection with the city. The building's façade appears layered and dematerialised. The lines of the sketch are inconclusive, and show openness and connection with the sky. The roof garden in also clearly visible.
In reality, the NYTB is an exclusive building (glazing is fixed). One could, however, associate the figurative openness of the building, as shown in this sketch, with the wishful transition from the exclusive skyscraper to a new generation of NYC environmentally selective high-rises.

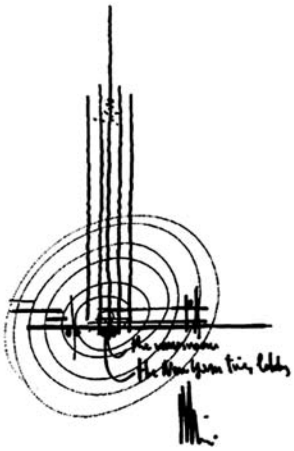

Fig 3. Piano's NYTB sketch.
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2.2 The Project's representation

The essential vision of the flagship sketch is reinforced and clarified in the project's representations. Here the renderings (Fig.4) show the façades blending with the outside. The project's model (Fig. 5) shows a see-through view of the volume, implying an image of lightness and transparency.
It could be argued that while the image of lightness often finds a correspondence with a building's physical properties, transparency is seldom delivered. It is striking how potent and appealing the vision of transparency continues to be in the 21st century. The environmental rationale behind the survival of highly glazed transparent facades in contemporary architecture could be found in the desire to rediscover a connection to daylight and the natural environment. Arguably, this will depend on the application of innovative interactive facades, allowing a building to satisfy occupant and owner needs and deliver building performance [15].

Fig 4. Rendering of the NYTB facade
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Fig 5. Model of the NYTB
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3. NYTB aesthetic vision and function of the ceramic rod façade.

An analysis of the building's guiding aesthetic vision and the function of the CRF considers:

- Transparency and solar heat gain
- Dematerialisation and shade
- Visual and environmental connection

3.1 Transparency and solar heat gain

In the NYTB aesthetic vision, transparency is reinforced by the company's desire for a symbolic connection between the transparency of the NYT media world and that of the building. From a functional perspective, transparency can provide access to daylight and visual connection with the natural environment, two ingredients considered essential in the NYTB. It can also, however, be the cause of energy penalties, for this building typology and location, primarily cooling loads. The question is: how is transparency pursued in the NYTB, and what are its implications to its sustainability goals?
Typically, transparency in high rise office buildings is pursued through highly glazed floor to ceiling envelopes. The issue of solar heat gain is addressed, besides using low-e glass, through tinting, frosting, or applying a ceramic frit, thus making the glass façade overall more opaque, with the consequent loss of visual connection to the outside.
In the NYTB, the CRF shades the building. It also allows the glass envelope to be more transparent by reducing its solar heat gain coefficient (SHGC). The base case SHGC of the glass envelope is 0.39. The calculated average SHGC of the CRF + glass system, however, is 0.27, well below ASHRAE standards (max. SHGC 0.39)[1]. It is important to compare this value to that of a similar building, by type and location. The NYC Bank of America (BOA) (LEED platinum) office building, for example, uses a highly glazed facade that relies exclusively on e-coating and ceramic fret to offset the transmission of solar heat gain. The SHGC of the BOA glass envelope, inclusive of the ceramic fret, is 0.32. The NYTB, therefore, gains 15.6% less solar heat energy per unit measure of the façade in respect to the BOA. Both the NYTB and the BOA pursue transparency, but their design aesthetics reveals two different approaches to sustainability. The NYTB façade aesthetic is engaged in and affects the building's sustainability goals. The BOA belongs to a more archetypal class of high rise building aesthetics, and uses prescriptive measures to reach exemplar sustainability credentials. The two approaches, which one could define respectively as *inclusive* and *prescriptive*, show two strong but diverging paths to sustainable architecture and for that reason call for thorough research investigation.
To date, based on light readings by director of construction Glenn Hughes, effective average lighting loads of the NYTB (based on 30 day readings) is of the order of 4.08 W/sqm with peaks of 5.38 W/sqm. This value appears excessively low when compared to the performance of similar installed dimming lighting systems (for very efficient systems not below 9.0 W/sqm), and would require further methodical readings for an entire year. It does, however, give an indication of the building's performance in respect to benchmarking. It represents, in fact, less than half the ASHRAE *interior lighting power allowance* [1]. Based on these initial readings, and assuming that the building's standard illumination target of 438-538 LUX is met 100% of the time, the building is efficiently lit.
Predicted cooling loads calculations from the mechanical engineer Flack and Kurtz, with and without the CRF, indicate that the CRF is accountable for reducing the building's overall solar heat gains by approx. 30 % and reducing energy costs of the building by approx. 13 % in respect to an equivalent building with an ASHRAE compliant SHGC of 0.39. [14].
The data on lighting load and cooling demand suggest that the CRF significantly reduces solar heat gains while allowing the building to harvest daylight and be efficiently lit. Transparency, it could be claimed, is pursued in a way that promotes the sustainability goals of the building, and this is achieved through the engagement of the CRF.

Fig 6. The NYTB South Facade

Most importantly, the CRF acts as a *passive system* that is assimilated in the craft of the building's design. The system contains the building's aesthetic, compositional and functional requirements and, as such, becomes both inside and outside, the *expression* of that building Fig. 6 [2].

3.2 Dematerialisation and shade

As with transparency, there is a desired semantic connection between the immateriality of the information world and the visual lightness of the building. Piano states that 'This building is about defying gravity. In some ways, it is like information…[]...immaterial.' [3]. What concerns us here is the robustness of the building's declared vision of immateriality and the function of the ceramic rods, namely to shade the building. If, one could argue, the visual lightness of the building is pursued through the *addition* of the four ceramic rod facades, then their *reason of being* could be reinforced by their shading effectiveness.

Aesthetically, the elevating ethereal effect of the CRF is pursued by the variable spacing of the ceramic rods. This variation corresponds, at each office level, to three distinct portions of the window (Fig.7).

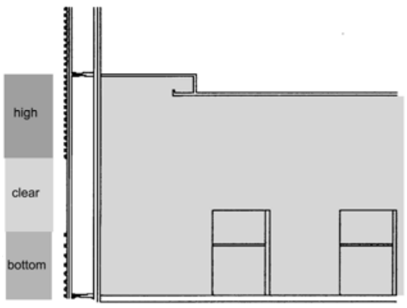

Fig 7. Section of the CRF through a typical office space.

In the high portion the rods are tightly and constantly spaced, in the clear portion the façade is rod-less, and in the bottom portion the rods are spaced more widely apart. In the high portion of the window, there is a strong correlation between the CRF qualitative and functional properties. These are respectively: to allow for view to and from the outside and to reduce solar heat gains (i.e. approx. 30%). This correlation, however, becomes weaker in two conditions: in the entire Northern CRF (rotated approx. 28 degrees due East) and in correspondence to the bottom portion of the office window.

The Northern CRF accounts for approx. 20% of the building's 186,000 ceramic rods. While its size is important, its function is limited to periods of the year when the sun crosses its plane. On those periods, two things occur that suggest a minimal contribution to the CRF shade function. Firstly, the sun's azimuth angle is highly pitched from the normal of the glass plane, and under those conditions the glass reflects most of the solar radiation. Secondly, the sun's altitude angle is low, making the horizontal rod array act more like a silhouette than an effective shading device. Bruce Fowle [6] and Gary Pomeratz of Flack and Kurtz [7] confirm this assumption and describe the Northern CRF as, respectively, 'only architectural in nature' and 'artistic'.

The rods of the bottom portion of the office window are spaced apart to allow for a clear view to and from the street (Fig. 8). Their shading function, however, concerns only the first 0.9 m (3ft) foot of the office space, corresponding to the cut off point of the Mechoshade system (beyond which the sunscreens are fully deployed to the ground). The mechanical engineers Flack and Kurtz confirm that, in this condition, the contribution of the bottom portion of the rods to the reduction of solar heat gain is negligible [14].

Fig 8. Spacing of the CRF in the lower portion of the office window.

It could be stated, therefore, that both conditions (the Northern CRF and the lower portion of the window), constitute a purely aesthetic, rather than a functional requirement of the building. However, whilst their shading effectiveness is negligible, they are arguably indispensable to the building's aesthetic unity.

This aesthetic requirement comes at a CO2 cost. The authors are currently investigating the whole life cycle carbon cost of the entire CRF, seen as an aesthetic system. The goal is to determine the break even point between the purely aesthetic CRF embodied carbon expenditure, and the entire CRF carbon savings in the building's energy consumption.

3.3 Visual and environmental connection

The NYTB aesthetic distinguishes itself from the iconic and visually hermetic high rise by attempting to establish a visual connection and response to the external environment. How is this pursued and what are the implications?

Visual connection

The visual connection *from* and *into* the building was, for the client, one of the project's proposal most valuable features [6]. It is therefore no surprise that there where high expectations in getting it delivered in the real building. The building, however, had also to comply with the NYC Worker's Union requirement, which allows a maximum cooling load flow of 30,000 cubic feet per minute (849 cubic meters) per air handling unit. That called for a careful orchestration on the number and spacing of the ceramic rods. The

rods were configured to allow maximum visual connection, while reducing solar heat gains so as not to exceed those requirements [14]. Particularly critical was the 'rod free' vision zone, where the client pushed for a larger rod free space, while the architect argued for a smaller one [5]. The outcome is the rod configuration we see in the finished building, which arrives at the maximum permissible allowance (with one extra rod added for safety).
Fig. 9 shows the fine tuning of the original number of rods to remain within an acceptable range of the CFM requirements. A total of three rods were removed from the original configuration, leaving 15 rods in the higher portion of the window and 7 in the lower portion, with the height of the vision window remaining unaltered at 0.8m above finished floor.

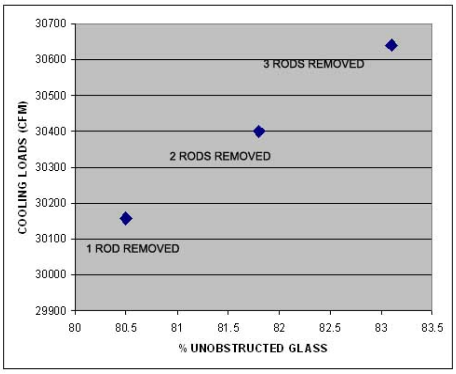

Fig 9. Study of cooling loads and visually unobstructed glass area in respect to rods removed (from Flack and Kurtz)

This limit condition (that is reached through the pursuit of what is in fact a qualitative value in architecture) is, arguably, not coincidental but representative of a critical and special condition of the design process. It is where qualitative and quantitative requirements meet and inform each other. If that is the case, it could suggest a strategy for the integration of sustainability goals with the building's aesthetic guidelines. To reach that goal it would seem crucial that these aspects have to be included at the design genesis phase, like this study suggest is happening with the NYTB.

Response to environmental conditions
It is important to state that the capacity of the NYTB to visually respond to the variable environmental conditions is only possible because of the particular nature of the ceramic rods. The circular section of the rods, and their off white brittle surface, makes them shiny and reflective. The rods not only block direct sunlight, but also allow for daylight to be reflected outside and inside the building. This establishes a connection between the building and the ever-changing variations of the intensity and colour of skylight, which is experienced by both the NYTB occupants and the pedestrians [5]. According to the authors, this connection gives the CRF and additional *reason of being.* Its presence is neither purely aesthetic, nor only merely functional, but allows an added value in architecture: the visual connection between the built and natural environment.
The CRF encounters a special condition where the building meets the sky. Aesthetically, the four projecting ceramic rod facades contain and crown the rooftop space. Functionally, they partly shade and protect from the wind the rooftop's outdoor space (assigned to the outdoor garden). Seen from this perspective, the continuation of the façade beyond the rooftop has a charged content. Firstly, it establishes a transition from the fully mechanical envelope to that of an open space. Secondly, it unifies the building vertically and horizontally. Thirdly, it revaluates the use of the rooftop, typically assigned in buildings to the role of *back alley*. Finally, it establishes a visual connection with the environment (Fig.10): as the intensity of sky light is reduced the CRF becomes almost transparent, as sunlight strikes the rods the facades glows with light and appears solid.
This richness in content, it could be claimed, is only possible through an effective integration of aesthetics vision and sustainability concerns.

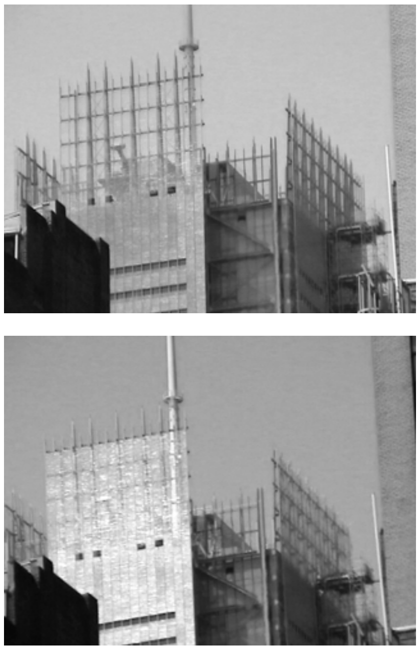

Fig 10. Response of lighting conditions in the NYTB rooftop.

5. Summary and Conclusion
The outcome of the investigation on the CRF of the NYTB is the following:

- The CRF is representative of a design approach that attempts to combine aesthetic vision and sustainable goals at the onset of the design process.

- The CRF acts as a passive system that pursues transparency with energy efficiency considerations. Because it contains the building's aesthetic and functional requirements, this system becomes the *expression* of that building.

- Parts of the CRF appear to be purely aesthetic and detached from any functional property. It is suggested, however, that the building's aesthetic should be considered as a system. The implications of the *entire* CRF to CO2 should determine both the CRF embodied carbon expenditure and the CRF carbon savings. Further research is required to determine the relationship, adding a voice to the aesthetic and sustainability discussion.

- The configuration of the CRF pursues one of the building's most desired features (visual connection from and into the building). In doing so it approaches a quantitative requirement of the building. This *limit* condition arguably represents a special moment in the design process, where qualitative and quantitative values inform each other, and could indicate to a strategy for integrating aesthetics and sustainability.

- Besides a purely aesthetic and functional role, the CRF proposes a third role that allows a visual connection between the building and the ever-changing environmental conditions. This additional role, that visually links the natural and built environment, is proposed by the authors as a potential added value in sustainable architecture, because it allows seeing the building's sustainability function.

Although the NYTB awaits post occupancy evaluation, the initial findings suggest that the aesthetic vision of a project, when inclusive of sustainability goals, can inform and stimulate the sustainability requirements of architecture.

The paper concludes that aesthetic vision and sustainability should be engaged as early as possible in the complex design genesis phase. This has the positive outcome of integrating a building's aesthetics with its sustainability goals, and pushing for innovative solutions in sustainable architecture.

6. Acknowledgements

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