Operative Buoyancy:
a retroactive research report

by

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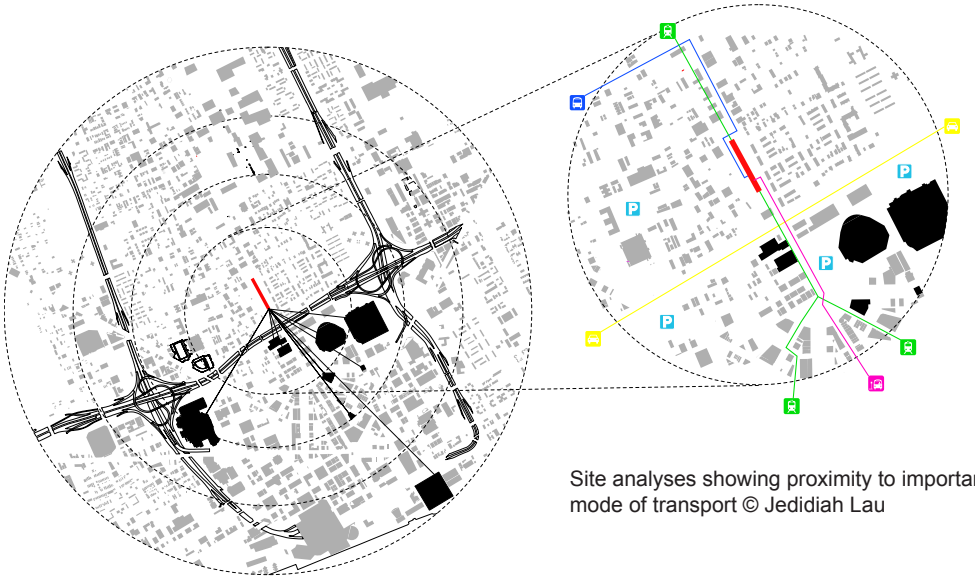
The Motor City for a majority of America's modern history has been the very symbol to the American dream. A city blanketed with soaring skyscrapers, robust industries, fancy neighborhoods and celebrated cultural institutions. Over the last 50 years however, the plot line of Detroit's fairytale has grown sourer and sourer by the day. Segregation and violent riots triggered mass exodus of the city as the white middle-class moved into the safer suburbs far from the downtown core, spreading the city's population farther and thinner every year. Since it's glory days half a century ago, Detroit lost over half of its inhabitants. The social, economical and physical conditions in Motor City have grown desperately frail. The recent economic downturn took no pity on the ailing city and viciously drove its deindustrialization further.[1] Unemployment rate reaches the new high of 22.2% as of January 2009 as population hits rock bottom at 800,000, its lowest in decades.[2] Driving around the current Detroit, it is hard to imagine that just few decades ago, this was one of America's most important and successful cities. The city fortunately is now in the process of a major infrastructure overhauls aimed to change its dreaded fate, new mass transportations systems are in the pipeline while major revitalization of existing system is in progress. Given the socioeconomic conditions, it was decided that the Concrete Thinking competition should be conducted in Motor City, giving it the irony it desperately needs...


Michigan Central Station © Yves Marchand


United Artists Theater © Yves Marchand


Packard Motor Plants © Yves Marchand

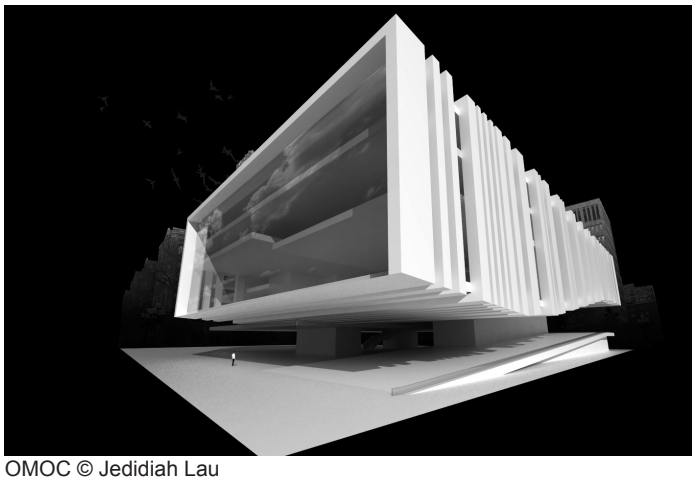
One of the top priorities of the Detroit Transit Hub project is to put an end to Detroit's urban exodus and re-densify it's deserted city center. We prioritized a clever choice of site as our first and most important strategy. After hours of Google street-view tours and a site visit we decided that the detroit transit station is to be built on the intersection of Woodward Ave. and Fisher Freeway. The decision to locate the station at the edge of the city, although strategically important, did not come as an obvious one. While proposing a mass-transit station at the downtown core of detroit would encourage everyday downtown-workmen to commute via light rail, it does not harness the vast potential of the city or the potential impact a station of such scale can offer. Compared to the denser fabric in the city core, the outer ring of downtown Detroit is peppered with empty lots full of potential for multi-family housing development, a prerequisite for young professionals to re-inhabit the city.


Site analyses showing proximity to important buildings and exisiting mode of transport © Jedidiah Lau

Responding to the long and narrow plot chosen as the site, the transit station's program are also horizontally arranged. All functions related to the light rail system are elevated to the second level to meet the tracks, opening the ground level for bus services and more commercial activities. Administrative spaces are located on the mezzanine level with an overview of the tracks as well as the rest of the station compound. Studying OMA/Rem Koolhaas' Cordoba Congress Center in Spain, we found that this linear arrangement of programs is very effective in creating a clear sequence of experience in a building, a quality ideal in a station where the way-finding of the architecture should be clear yet unobtrusive.[3] Also, as the station lies parallels to Woodward Ave., it functions as an urban threshold, defining the commercial and residential of the now-ambiguous area. A linear station also maximizes its impact on the city in terms of activating empty plots and jump-starting the neighborhood. the 200-meter long transit hub allowed all the programs to face Woodward Ave. while keeping the residential area on its west quiet and undisturbed. Moreover, the stretched rectangle form provided over 60 percent more area facing the main street over a square form, thus maximizing its urban impact in Detroit.

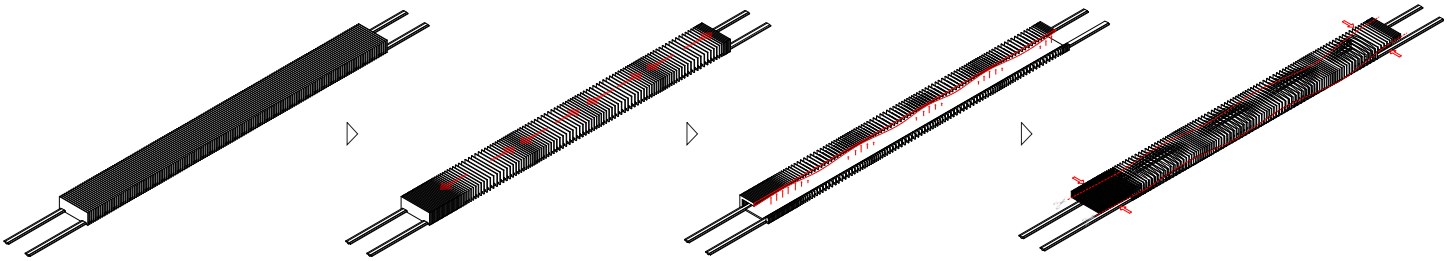
Cordoba Congress Center © OMA/Rem Koolhaas

The architecture of the Detroit Transit Hub was greatly influenced by a system previously tested on 3A student's cultural center project and featured a processss of morphology coined "Operative Articulation". Operative Articulation involves a system of pre-fabricated structural membranes that vary in size, frequency and density based on the structural and programmatic parameters set by the programs it serves. The Ontario Ministry of Culture scheme involving such operation was eventually abandoned in favor of a more conventional construction due to the scheme's need for exterior LED displays.



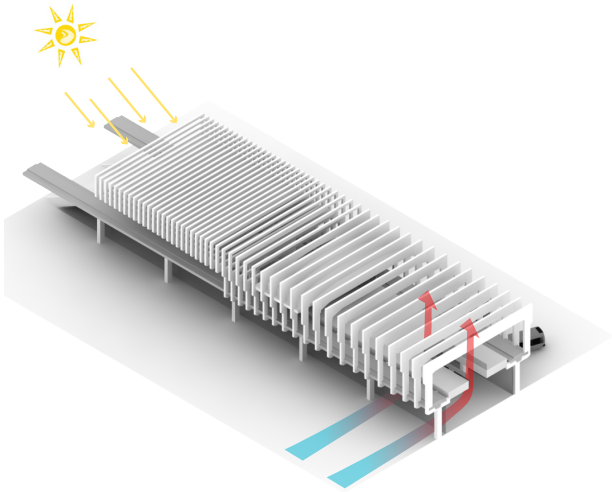
OMOC © Jedidiah Lau

In the case of the Detroit Transit Hub, we found this strategy to be extremely fitting as the station could perform with incredible material efficiency without spatial compromises thanks to the effective manipulation of pre-fab concrete supports. The operative articulation of structural density and size allows the transit station to perform flexibly and responsively to its environment and program. The dense array of concrete frames is passively heated in the winter to provide the south-facing lobby and administrative spaces the maximum amount heat and light. Alternately, the traffic intensive lobbies are shaded to minimize energy spent in cooling.



Detroit Transit Hub, Morphology Diagrams © Jedidiah Lau

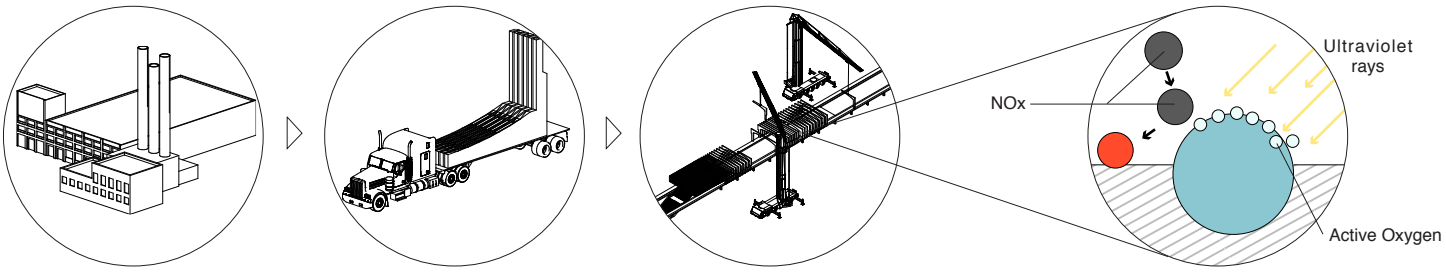
Detroit Transit Hub, view from Woodward Ave. © Jedidiah Lau



Detroit Transit Hub, sun / ventilation diagram © Jedidiah Lau

Furthermore, an atrium vertically connects the bus terminal on ground floor with the light rail platform above. This connection not only provide easy way-finding for travellers unfamiliar to the station but more importantly naturally ventilates the building through the air transfer from the ground to the platform through the atrium space.

Not only is the pre-fabricated system sustainable within the design model but the very assembly of this system is designed to minimize environmental impacts caused by the construction of projects at this scale. Each frame within the system can be fabricated in a local manufacturer, transported via trucks and assembled on site. This flexible pre-cast system eliminates the need of formwork usually required in the conventional concrete construction and consequently reduces the time and energy consumed in the construction process.



Detroit Transit Hub, production / assembly diagram © Jedidiah Lau

Strategies for a better environment were no less considered at a molecular scale. The entire concrete system of the station will be built with self-cleaning concrete. Having studied a wide range of concrete precedents ranging from projects by Corbusier to Zaha Hadid, the team concluded with the selection of a self-cleaning concrete under the advice of Prof. Terri Boake. This type of concrete was most famously used in Richard Meier's Jubilee Church. The church, completed in Rome in 2003 maintained its crisp white surface without serious maintenance, as if by divine power. The miracle in this case of course was the self-cleaning concrete. Apart from its high waterproofing qualities and lower cost of construction, self- cleaning concrete actively cleans itself and the environment around it. The photocatalytic cements within the concrete uses ultraviolet light in sunlight to accelerate chemical reactions and is able to quickly decompose a high range of pollutants from tobacco smoke to the fog-generating nitrous oxides (NOx) and sulfuric oxides (SOx). The choice of such concrete would not only keep the station bright and clean in years to come but also improve the air quality of the surrounding area![4]

Jubilee Church, Richard Meier © Andrea Jemolo

The Detroit Station is more than a transportation hub, it is an architectural manifesto of a new mode of living; a lifestyle independent of personal vehicular transport but moreover a way of thinking and design that intimately integrates issues of sustainability across all scales. The dynamic spaces within the station is crafted out of the relationship between load and frequency and demonstrates concrete's strong yet malleable characteristics. The station boldly showcases concrete's versatility: ornament, structure, space - indistinguishable under the crisp white wave of concrete and light.


Detroit Transit Hub, interior view © Jedidiah Lau

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Images:

1, 2, 3: Yves Marchand

4, 6, 7, 8, 9, 10, 12: Jedidiah Lau

5: OMA / Rem Koolhaas

11: Richard Meier / Andrea Jemolo