

Convening on Urban Ecology

Impact of architectural design on environmental sustainability

DATE 19/05/2022

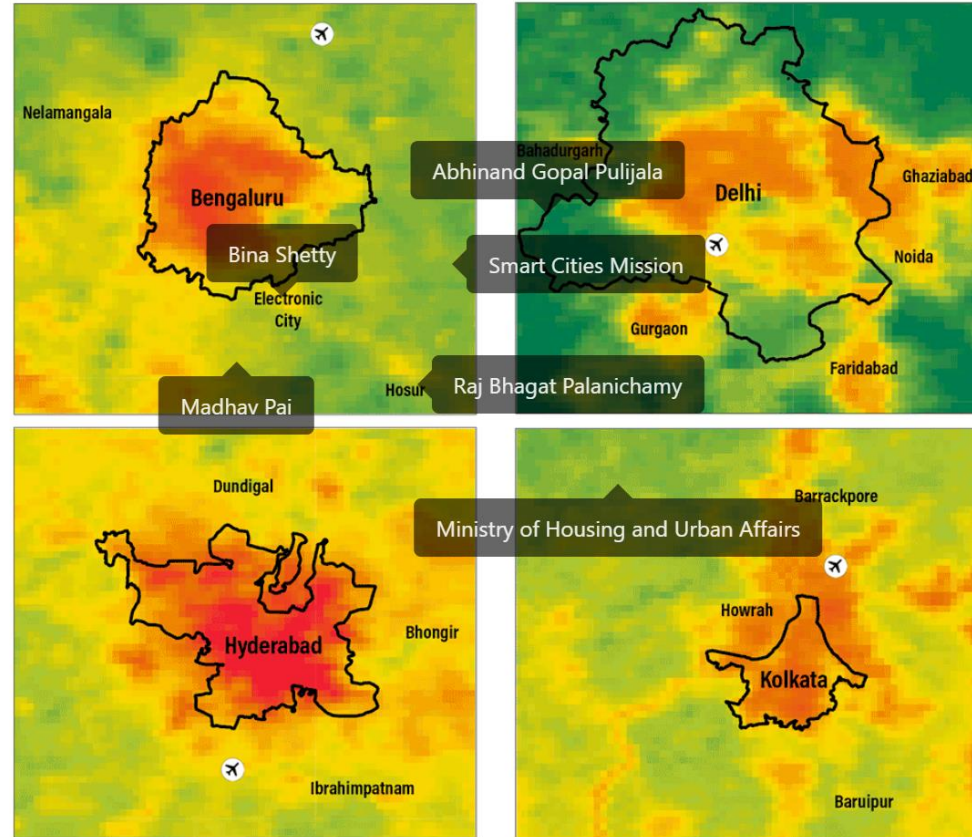
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TEMPERATURE RISE DUE TO ANTHROPOGENIC ACTIVITIES

Urban Heat Island Effect across Indian Cities from 2001 to 2021 **2021**



Night-time Land Surface Temperature - Annual Average: +16°C +24°C

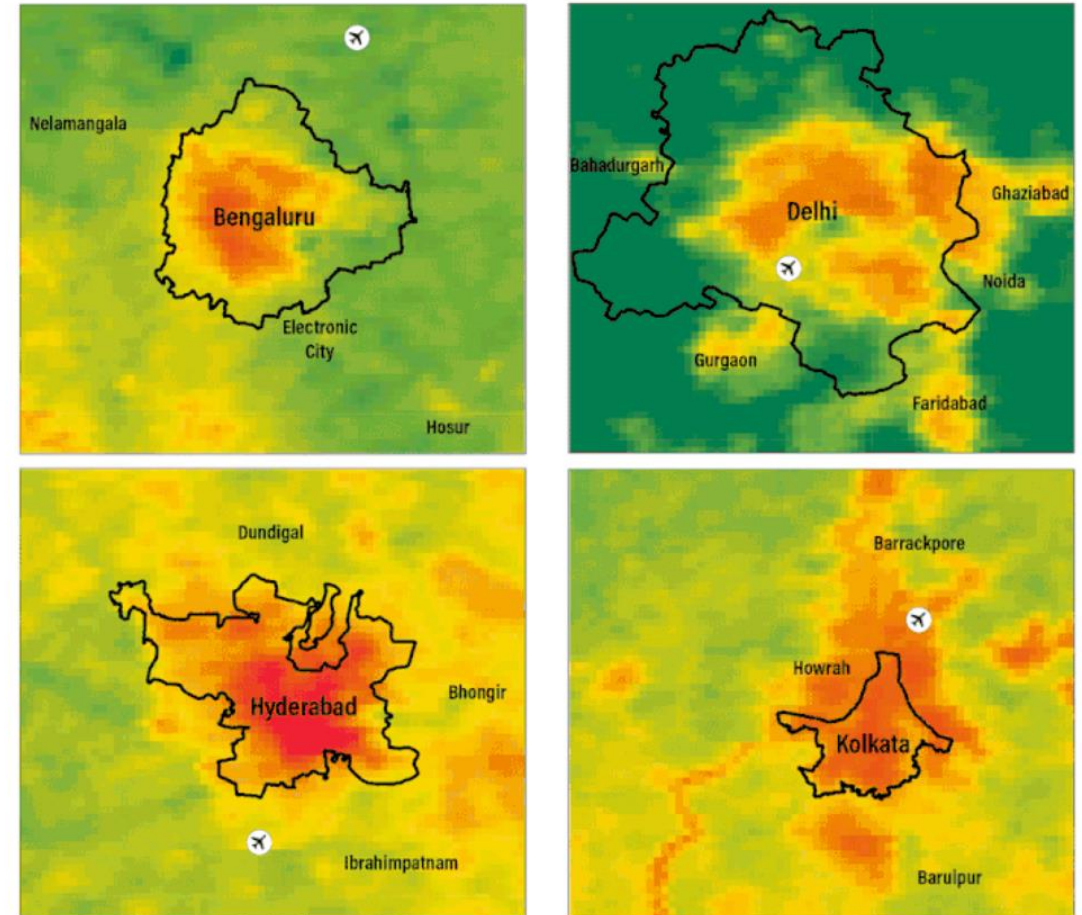
□ respective Municipal Corporation boundaries



Source: WRI Geo-Analytics; MODIS 2001, 2021; Processed using Google Earth Engine

WRI INDIA
— ROSS CENTER

Urban Heat Island Effect across Indian Cities from 2001 to 2021 **2008**



Night-time Land Surface Temperature - Annual Average: +16°C +24°C

□ respective Municipal Corporation boundaries



TEMPERATURE RISE IN URBAN AREAS

The effects –

- Health
- Possibility of Decent Work
- Traffic Accidents

• Solution sought –

- Decent Work:

Whether it is the area of work or at home, the rise in temperature effects sleep patterns which effects the possibility of work.

It also effects traffic. Traffic accidents occur due to loss of concentration and fatigue.

“A South Australian study of workers’ compensation claims found for every degree above 14°C, occupational injuries requiring more than three days off work increased modestly (0.2%).”

Ref: <https://theconversation.com/car-accidents-drownings-violence-hotter-temperatures-will-mean-more-deaths-from-injury-129628>

Lack of Decent Work effects Family --- Health , Nutrition , and Education --- creating a Vicious Cycle

Material and Urban Planning

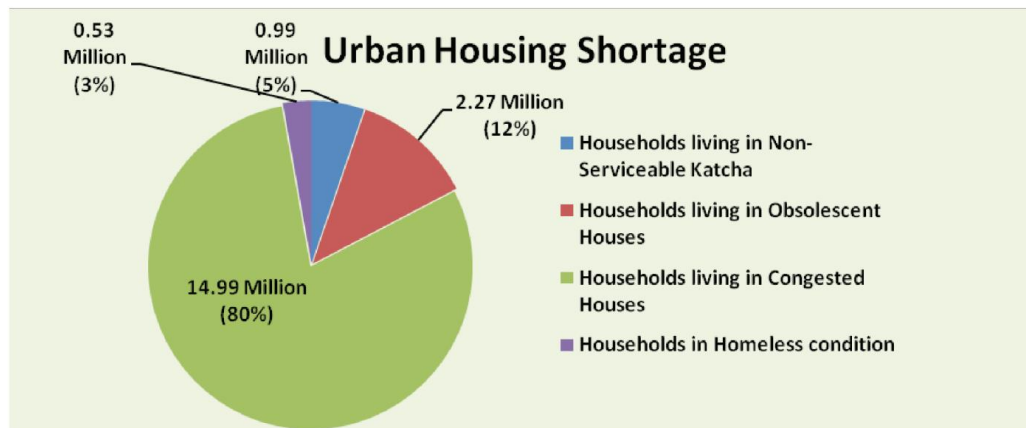
- This an important aspect –

We, are low on HDI (Human Development Index) in most parameters. To attain better HDI we must invest of Infrastructure and the infra structure demands construction thus leading to need of materials.

The infrastructure here includes housing---

80% of Urban population lives in congested housing.

Figure-26 Estimated Urban Housing Shortage in India – 2012



Source: Report of Technical Group(TG-12) on Estimation of Urban Housing Shortage 2012 , National Buildings Organisation, Ministry of Housing & Urban Poverty Alleviation.

Congested housing impacts ventilation and therefore heat in the residences.

Heat effects sleep. So, even a poor household invests on an AC.

“Currently, many households are spending around 40% of their income on electricity. In a survey of 1,244 SRH households in Mumbai, Bardhan found that ownership of AC units rose by 100% after people moved from the slums to SRH.” <https://www.cam.ac.uk/stories/indias-slum-rehabilitation-housing>



NEW DELHI: Air conditioner makers, including Voltas, Daikin and Panasonic, are expecting a high double-digit growth in sales this year on account of reports of rise in average temperature this summers, increasing disposable income and availability of power in smaller cities.

Samsung, Godrej Appliances, Haier and Intex too expressed optimism over double-digit growth in AC sales numbers.

Ref:<https://economictimes.indiatimes.com/industry/cons-products/durables/ac-makers-expect-high-double-digit-jump-in-sales-in-2018/articleshow/63453612.cms>

Certainly, Temperature Rise is an impediment to many but also a business opportunity . The prices of AC are coming down, loans and deferred payments are available. The manufacturers have also designed inverter ACs so that power cut is not a deterrent to a comfortable sleep.

Urban Heat Island Effect: Cutting down on trees, paving earth , Buildings with glazing, and Air conditioners are the main contributors to this effect.

Urban Bye Laws and need for the change:

- The rationale behind developing a Bye Laws is obfuscated.
- It is veiled behind economics and densification and not related to Eco system.
- A new narrative is needed –
 1. The new narrative should be based on local eco system conditions and must be granular.
 2. Bye laws can be suggestive but not regulative.
 3. This will have to be granular and decentralized with granular data and reliable inputs with locals deciding about their habitats than a top-down approach.

In the new narrative

- “A cool space to live/work is a human right.”

The vicious cycle of demand for cool spaces and increase in electricity demand leading to environmental degradation needs to be broken.

- Prioritize **Shade** in public areas in most of our cities.
- Heat and Energy generation are interlinked –Urban planning needs to work at localizing both – in simpler terms **Cool Day Lit Interiors**. Reimagine the **Underground** for living/ working and providing materials for construction.
- Bye laws based on Carrying Capacity ... example 40 sq m / person through **Smart Roofs** .

Prioritize Shade



<https://bangaloremirror.indiatimes.com/bangalore/cover-story/856-trees-to-be-chopped-in-2-8-km-stretch-around-bangalore-palace-grounds-no-stopping-ecological-disasters/articleshow/55607789.cms>



<https://www.outlookindia.com/website/story/delhi-municipal-corporation-proposes-cleanliness-drive-for-connaught-place-corridors-bus-terminus-near-shivaji-stadium/403418>

Prioritize Sun for daylit interiors and Solar Energy

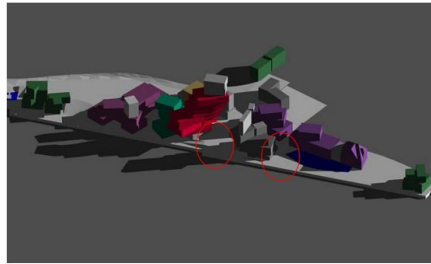
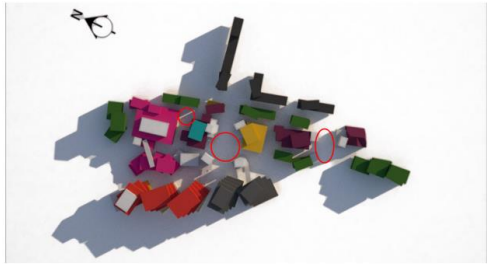


Figure 11: Shadows at 9.00 on the 21st September before (left) and after adjusted master plan

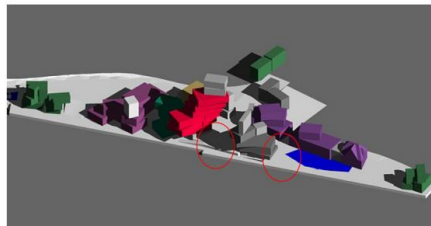


Figure 12: Shadows at 12.00 on the 21st September before (left) and after adjusted master plan

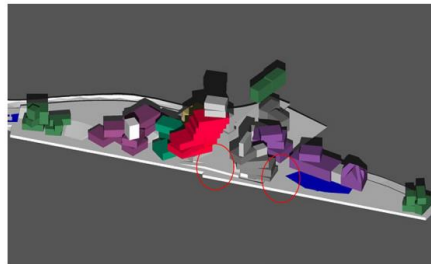
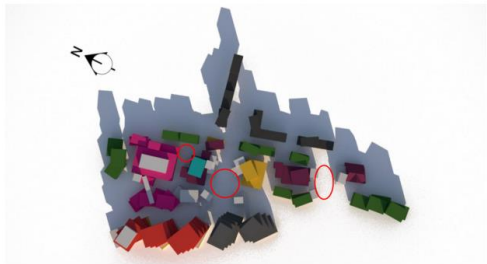
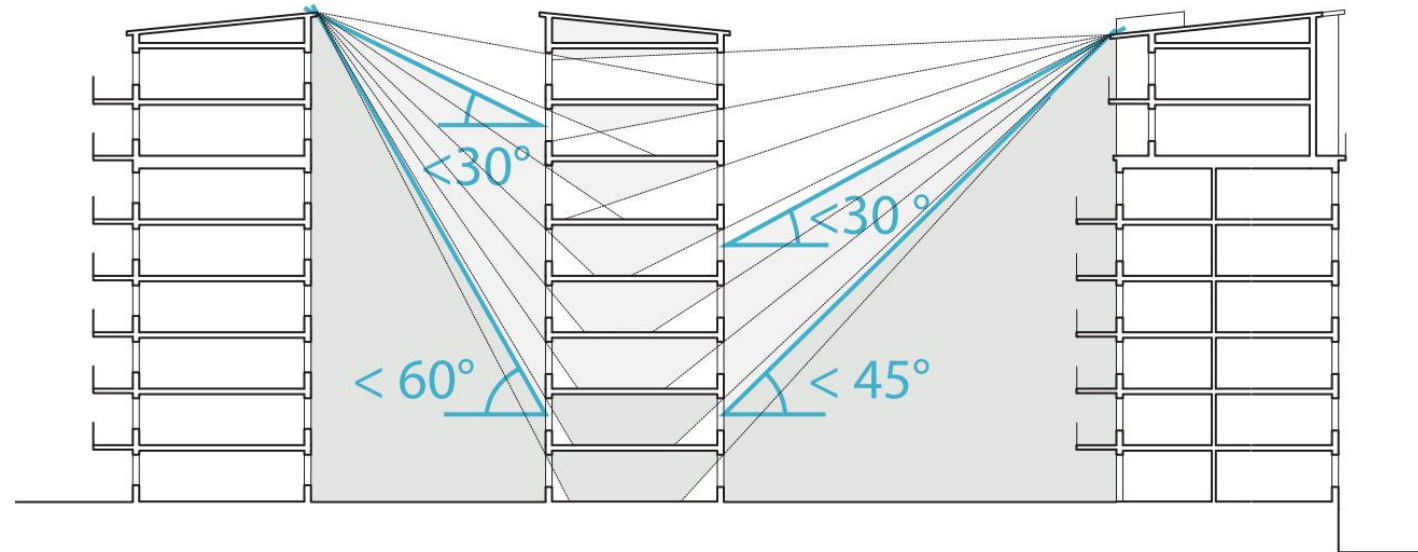


Figure 13: Shadows at 15.00 on the 21st September before (left) and after adjusted master plan



Study of obstruction angles to calculate how much sun reaches the interiors.

Think of the Underground...



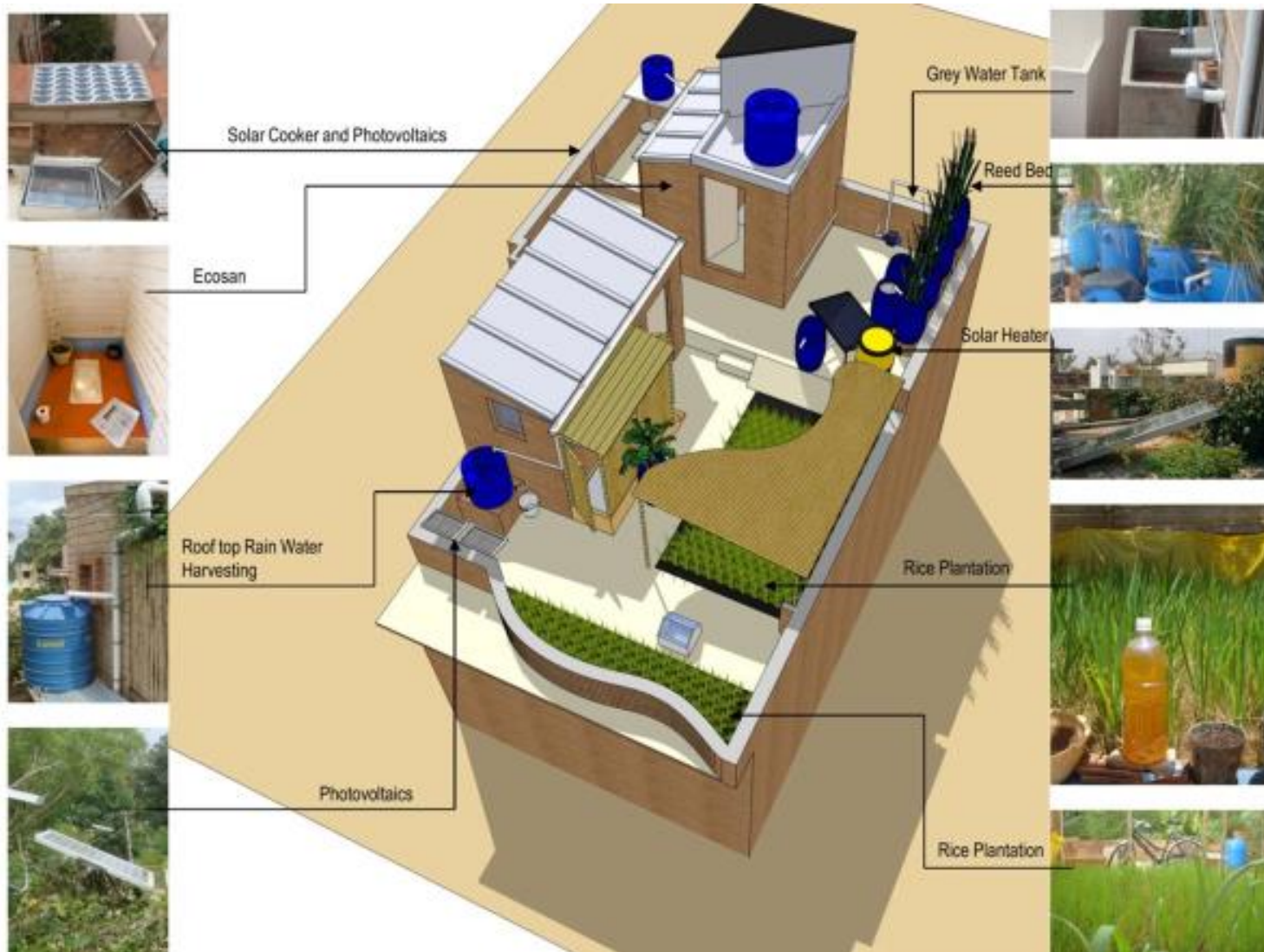
Derinkuyu Cappadocia Turkey

<https://www.theguardian.com/cities/2014/may/30/ancient-underground-city-cappadocia-fruit-produce-warehouse>



Amox Rex Helsinki

Smart Roof



- 1...For water needs
- 2...For energy needs
- 3...For food needs
- 4...For taking care of the humanure
- 5...For Bio-diversity...

The Underground



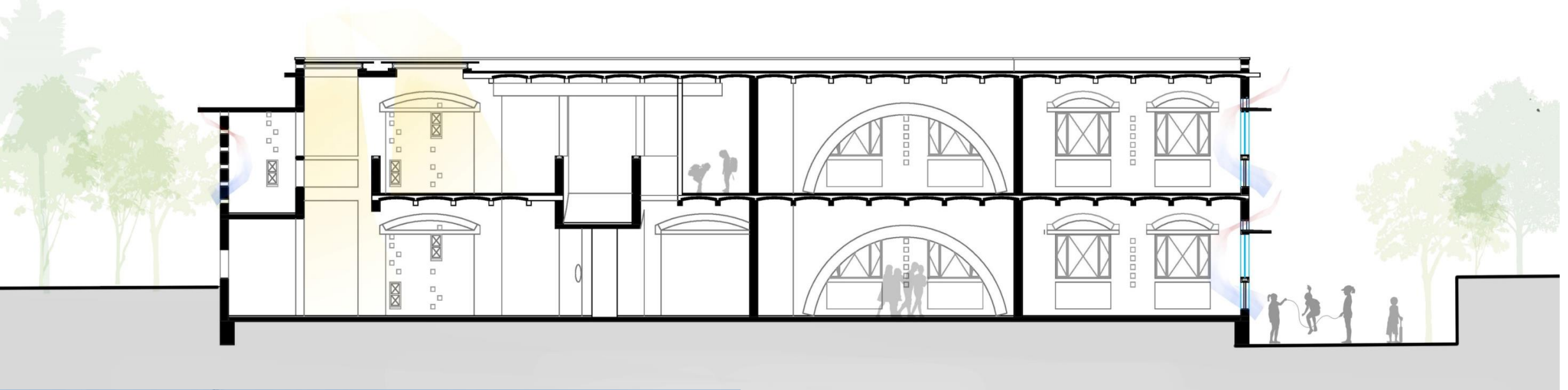
Underground – source of material for construction

	Units	Mini	Amit	Vasanthi	Uma	Ghosh	Sheeba
Plot Area	sq.m.	368.0	218.5	220.8	147.2	346.7	220.8
Built Up Area	sq.m.	290.9	272.0	389.6	175.5	151.4	225.0
Basement Area	sq.m.	80.9	64.7	126.0	0.0	0.0	0.0
Soil Available	cu.m.	149.3	149.3	263.8	0.0	0.0	0.0
Soil Required for Earth blocks	cu.m.	55.2	55.6	38.8	43.9	27.1	47.0
Embodied Energy/ Earth Walls	KJ/m3	406.0	412.0	290.0	333.0	270.0	348.0
Embodied Energy/ Burnt Brick	KJ/m3	1027.0	1043.0	734.0	844.0	683.0	881.0



A basement with garden- better light/ventilation at Hamsa Prasanna's home...

- Walls in the School with earth block from Hamsa Prasanna's home...



YELLOW TRAIN- SCHOOL- MOTHER OF ALL UNDERGROUNDS -2011

But not at the cost of
aquifer



Raghu Rai's picture of Agrasen Ki Bawli in 1976



My picture of Agrasen Ki Bawli on a cold rainy
day January 2020

•Thanks

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