DRS- Paper

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Indian Institute of Technology Bombay (IITB) campus map redesign: Visual and information design decisions and their impact on perception and wayfinding in a portable campus map.

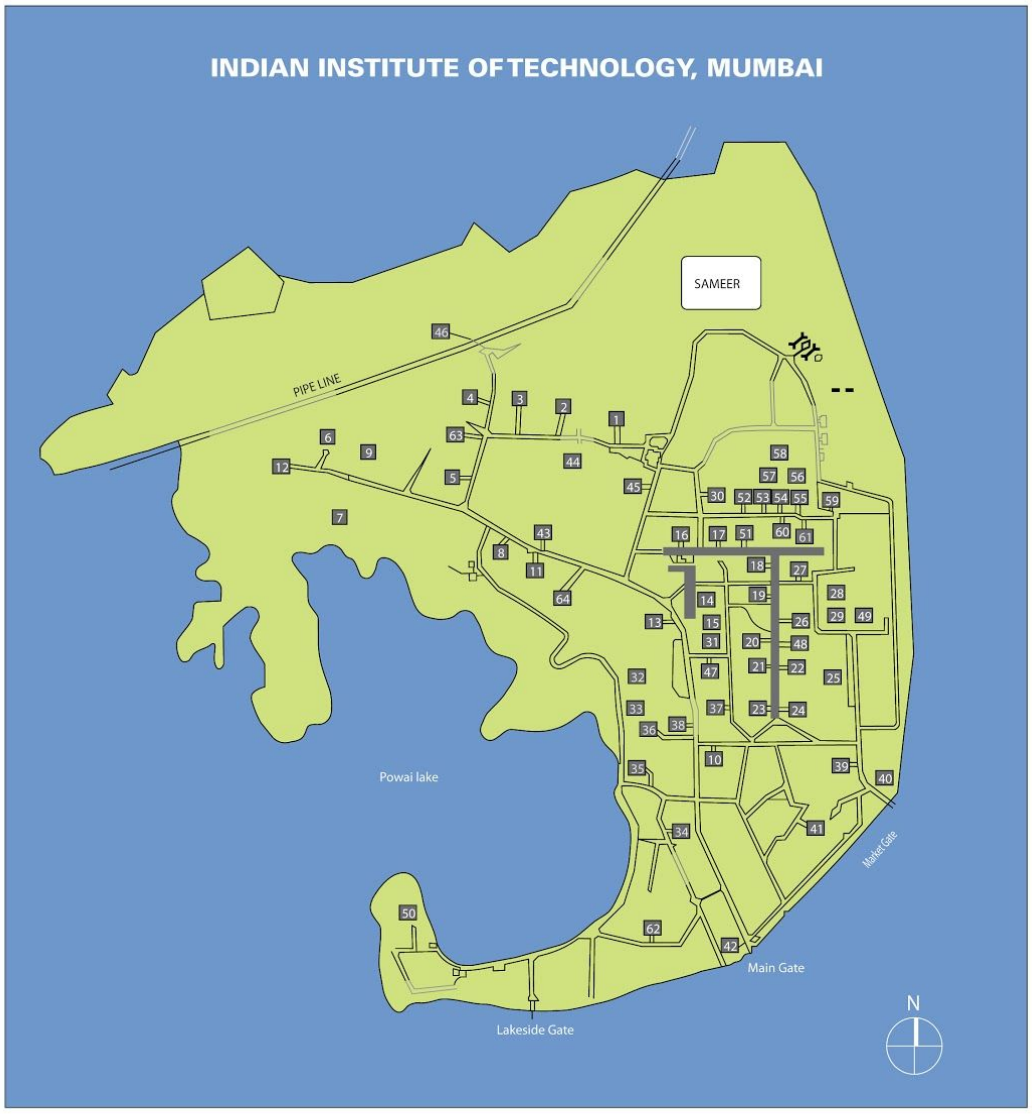
Signature of Guide: Prof. Mandar Rane.

Indian Institute of Technology Bombay (IITB) campus map redesign: Visual and information design decisions and their impact on perception and wayfinding in a portable campus map.

Maps are wonderful examples of information design. Information design is organizing of information such that the hidden content is brought out in the right context and underlying patterns and relationships if any are made visible. The redesigned portable IITB campus map is a reference map. The purpose of this map is to help visitors find their way around 550 acres of sprawling IITB campus. In India, people are more comfortable asking for directions than reading maps. In this context we looked at the existing IIT Bombay campus map to find out difficulties people faced while using it.

Analysis of the earlier campus map:

To begin with, date was not printed on the existing campus map, making it difficult to guess if the information is up to date and reliable. Entry points to the campus, an important detail, were ambiguously placed. The map key and corresponding location numbers on the map appeared well organized but it took fairly long time to look up any place on campus. For example, if you want to look up Solar Lab (number 61, see fig. 1) where will you start searching from- the top, bottom, left or right? There was no clue where to start searching from, thus the act of looking up a place on the map seems pretty random. The map key has an alphabetical order. But the drawback is that the user has to know correct names of destinations to be visited. Say, you are a first time visitor on campus and are looking for a restaurant. You look up this map, but there is no sign of an eating place or any name with the word ‘restaurant’ next to it. That is because the restaurant at IITB is called ‘Gulmohar’. How is a first time visitor supposed to know this? Is organizing names in alphabetical order, the only strategy to design a map key? What other ways of organizing the map key could be explored, so that it is user friendly, even to the first time visitor? With this in mind, the map redesign process began.



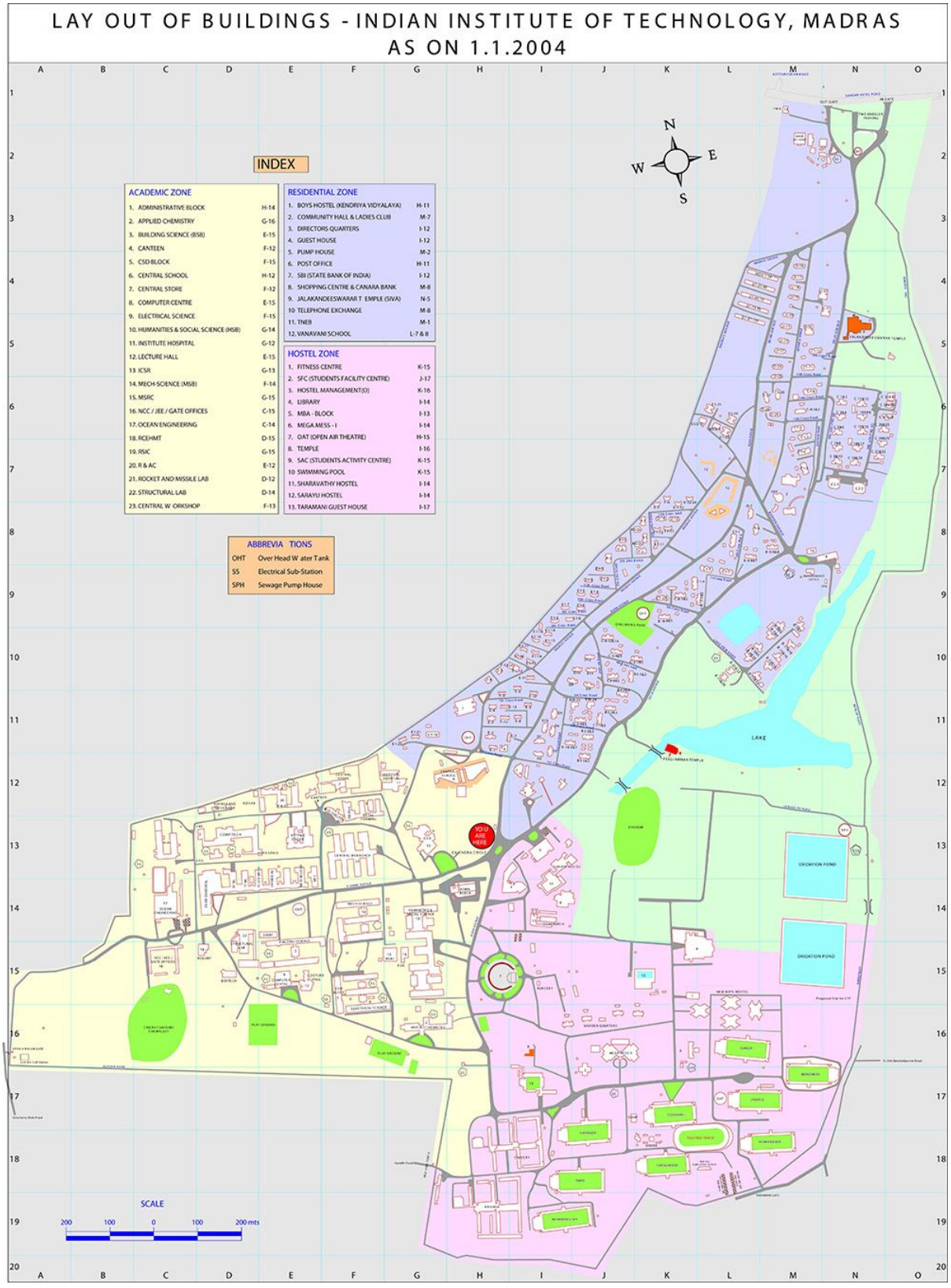
1. HOSTEL NO - 1
2. HOSTEL NO - 2
3. HOSTEL NO - 3
4. HOSTEL NO - 4
5. HOSTEL NO - 5
6. HOSTEL NO - 6
7. HOSTEL NO - 7
8. HOSTEL NO - 8
9. HOSTEL NO - 9
10. HOSTEL NO - 10
11. HOSTEL NO - 11
12. HOSTEL NO - 12 & 13
13. CONVOCATION HALL
14. MAIN BUILDING
15. LECTURE THEATER
16. CENTRAL LIBRARY
17. MATHEMATICS
18. MECHANICAL ENGG.
19. CIVIL ENGG.
20. ELECTRICAL ENGG.
21. METALLURGICAL ENGG.
22. HUMANITIES & SOCIAL SCI.
23. PHYSICS
24. CHEMICAL, CHEMISTRY
25. AERONAUTICAL ENGG.
26. CSRE
27. IDC
28. STORES & ESTATE OFFICE
29. CESE
30. SAIF & ACRE
31. S.O.M. & I.R.C.C.
32. HOSPITAL
33. STAFF CLUB
34. DIRECTOR'S BUNGALOW
35. GUEST HOUSE
36. DRUAPAD SANSAR
37. K.R.E.S.I.T.
38. VANVIHAR GUESTHOUSE/ GULMOHAR
39. CENTRAL SCHOOL
40. POST OFFICE
41. CAMPUS SCHOOL
42. STATE BANK
43. BADMINTON COURT
44. NCC OFFICE
45. SAC/SWIMMING POOL/ GYMKHANA
46. SEWAGE PLANT
47. COMPUTER CENTRE
48. EARTH SCIENCE
49. CONSTRUCTION DIV
50. DEVI TEMPLE
51. COMPUTER SCIENCE DEPT.
52. ENERGY SYSTEM LAB
53. HYDRAULICS LAB
54. HEAVY STRUCTURE LAB
55. HEAT TRANSFER
56. STEAM POWER LAB
57. CENTRIFUGAL LAB
58. VIHAR HOUSE
59. POWER HOUSE
60. I.C. ENGINE LAB
61. SOLAR LAB
62. WHITE HOUSE
63. TANASA HOUSE
64. STAFF HOSTEL

(Fig.1)

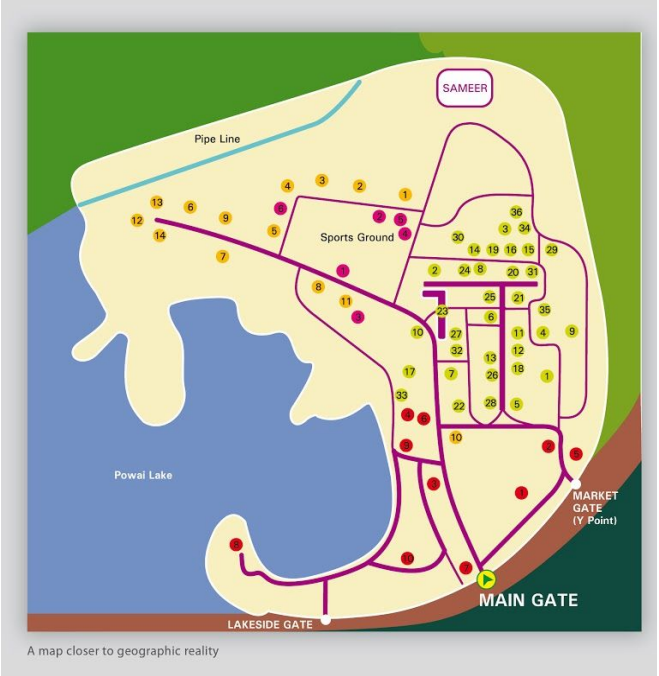
Redesign Process: Map diagram

(Fig 2)

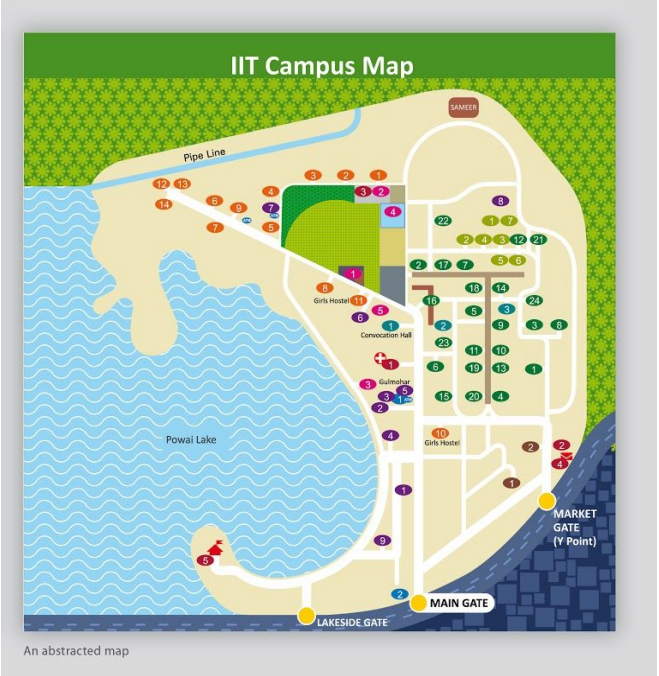
Even though we navigate daily through a perceptual world of three spatial dimensions…the world portrayed on our information displays is caught up in the two-dimensionality of the endless flatlands of paper (Tufte, E.R. 1990). The case of portable printed IITB campus map is similar. It is a bird's eye view representation of three dimensional realities of a 550 acre campus on 11.5" X 6.75" size printed map. The first significant change we made to the existing map was to redistribute area assigned to the campus and Powai Lake. Instead of reproducing the **geographic reality** of the campus as is, we distorted it for a reason.


LAY OUT OF BUILDINGS - INDIAN INSTITUTE OF TECHNOLOGY, MADRAS
AS ON 1.1.2004
INDEX
ACADEMIC ZONE
1. ADMINISTRATIVE BLOCK H-14
2. APPLIED CHEMISTRY G-16
3. BUILDING SCIENCE (BSB) E-15
4. CANTEEN F-12
5. CSD BLOCK F-15
6. CENTRAL SCHOOL H-12
7. CENTRAL STORE F-12
8. COMPUTER CENTRE E-15
9. ELECTRICAL SCIENCE F-15
10. HUMANITIES & SOCIAL SCIENCE (HSB) G-14
11. INSTITUTE HOSPITAL G-12
12. LECTURE HALL E-15
13 ICSR G-13
14. MECH-SCIENCE (MSB) F-14
15. MSRC G-15
16. NCC / JEE / GATE OFFICES C-15
17. OCEAN ENGINEERING C-14
18. RCEHMT D-15
19. RSIC G-15
20. R & AC E-12
21. ROCKET AND MISSILE LAB D-12
22. STRUCTURAL LAB D-14
23. CENTRAL W ORKSHOP F-13
RESIDENTIAL ZONE
1. BOYS HOSTEL (KENDRIYA VIDYALAYA) H-11
2. COMMUNITY HALL & LADIES CLUB M-7
3. DIRECTORS QUARTERS I-12
4. GUEST HOUSE I-12
5. PUMP HOUSE M-2
6. POST OFFICE H-11
7. SBI (STATE BANK OF INDIA) I-12
8. SHOPPING CENTRE & CANARA BANK M-8
9. JALAKANDEESWARAR T EMPLE (SIVA) N-5
10 TELEPHONE EXCHANGE M-8
11. TNEB M-1
12. VANAVANI SCHOOL L-7 & 8
HOSTEL ZONE
1. FITNESS CENTRE K-15
2. SFC (STUDENTS FACILITY CENTRE) J-17
3. HOSTEL MANAGEMENT(O) K-16
4. LIBRARY I-14
5. MBA - BLOCK I-13
6. MEGA MESS - I I-14
7. OAT (OPEN AIR THEATRE) H-15
8. TEMPLE I-16
9. SAC (STUDENTS ACTIVITY CENTRE) K-15
10 SWIMMING POOL K-15
11. SHARAVATHY HOSTEL I-14
12. SARAYU HOSTEL I-14
13. TARAMANI GUEST HOUSE I-17
ABBREVIA TIONS
OHT Over Head W ater Tank
SS Electrical Sub-Station
SPH Sewage Pump House
N
W
E
S
YOU ARE HERE
LAKE
OXIDATION POND
OXIDATION POND
SCALE
200 100 0 100 200 mts

(Fig 3)



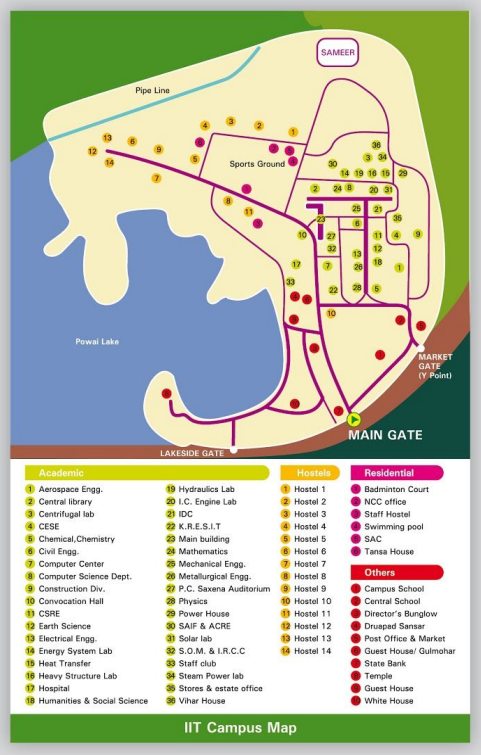
A map closer to geographic reality



An abstracted map

(Fig 3.1)

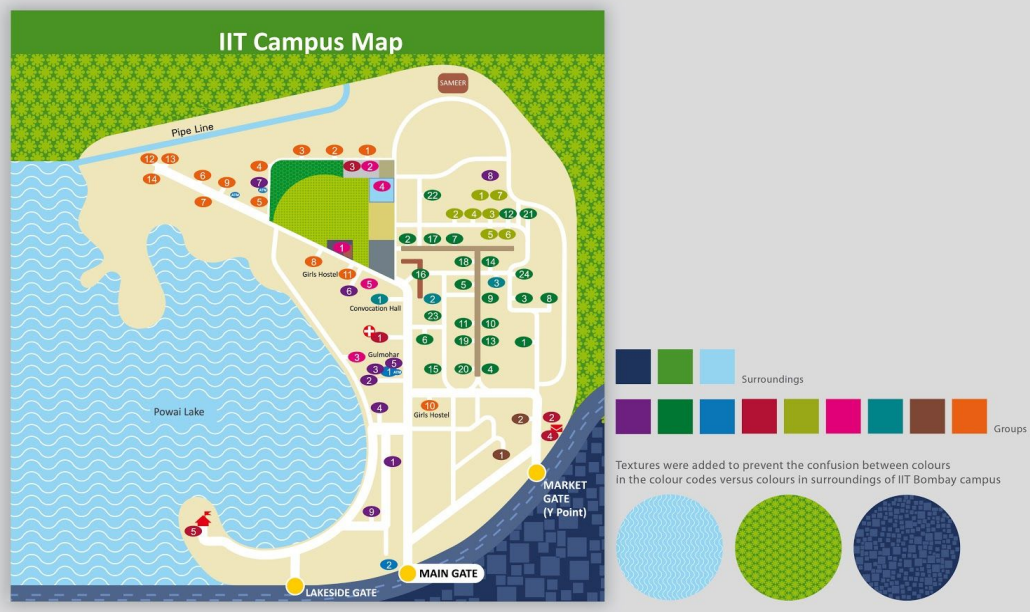
We assigned more **visual real estate** to IITB campus by reducing area allotted to Powai Lake. Although reduced, Powai Lake was retained as it helps in orientation. This distortion allowed for many details about the campus to be accommodated, considering the size constraints of the portable.



Map 2

Map 3

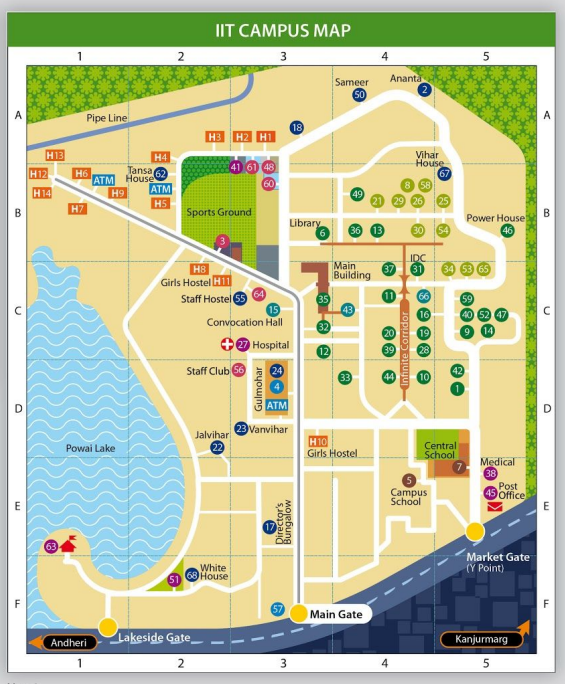
(Fig 4)



(Fig 4.1)

Textures were used to delineate the surrounding areas and help separate them from the main campus.

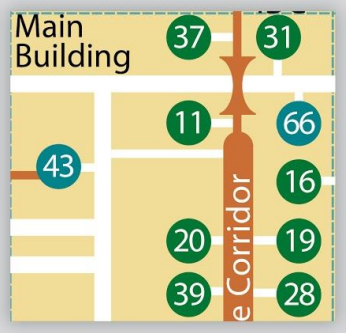
Map 3



Map 4

(Fig 5)

In earlier iterations, due to absence of grids one had to search through entire map area to be able to locate a place



Now one has to search only in the smaller area defined by the grid code, in this case, one has to find the number 11 in area defined by C4

Looking up C4 using the grid

(Fig 6)

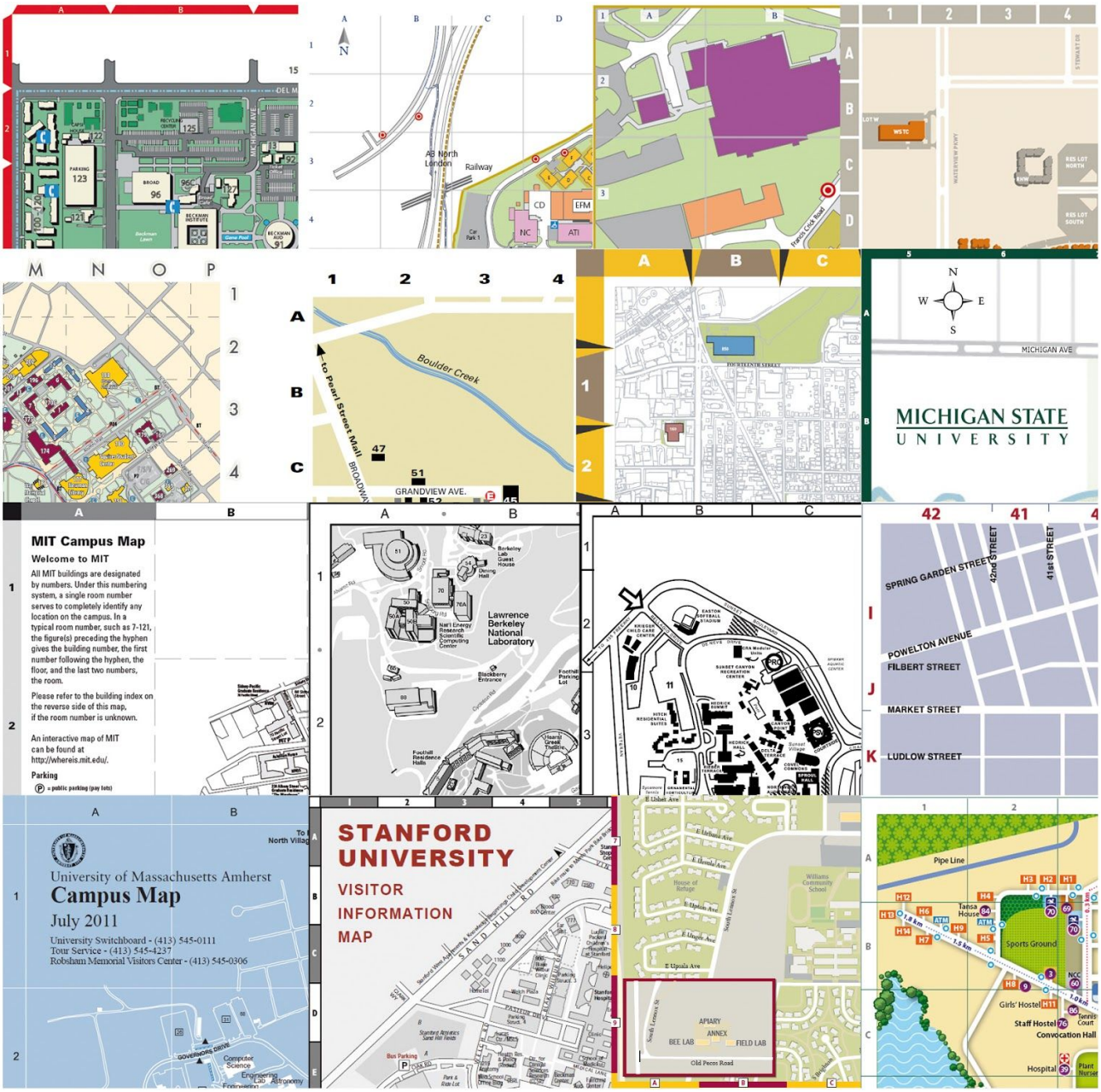
Alpha-numeric grid[1] has made searching within the map easy by reducing the visual scan area. This saves time. What do we mean by that? Do you remember how you struggled to find Solar Lab in the earlier map? This time, look up Civil engineering in the legend, you will notice C4, 11 the grid code, now look up 'C' and '4' on the grid and you will notice the number 11**.** You see, you looked up Civil Engineering only in the small area that is C4 and not the entire map diagram. In the redesigned map, the grid reduces the area of search from the entire map diagram to only the space represented by the square block C4.

How many divisions are appropriate in case of a campus map grid? One cannot make a blanket statement about optimum number of grid divisions. However the number of grid divisions should be decided depending upon the size of the map such that dense areas get distributed into smaller search areas.

Although grids reduce the scan area and save on time, not all first time map users are aware of how grids work and how they can be used in context of this portable campus map. As Tufte points out *"…despite what many people think, graphical representations are less suitable for inexperienced readers. The fact is that they require a degree of intellectual training. Pictorial representations are not necessarily 'easier'; rather, they are more concise, more compact, clearer and, when well-done, more compelling."* (Tufte, E.R. 1983

There can be several visual representations for a grid. Which visual design strategy is most appropriate? Should the grid stand out and call attention to self or should it be visually muted compared to the rest of the campus map elements? We discuss this later, in a section titled 'overview of campus maps from around the world'.

[1]An alphanumeric grid (also known as atlas grid) is a simple coordinate system on a grid in which each cell is identified by a combination of a letter and a number.

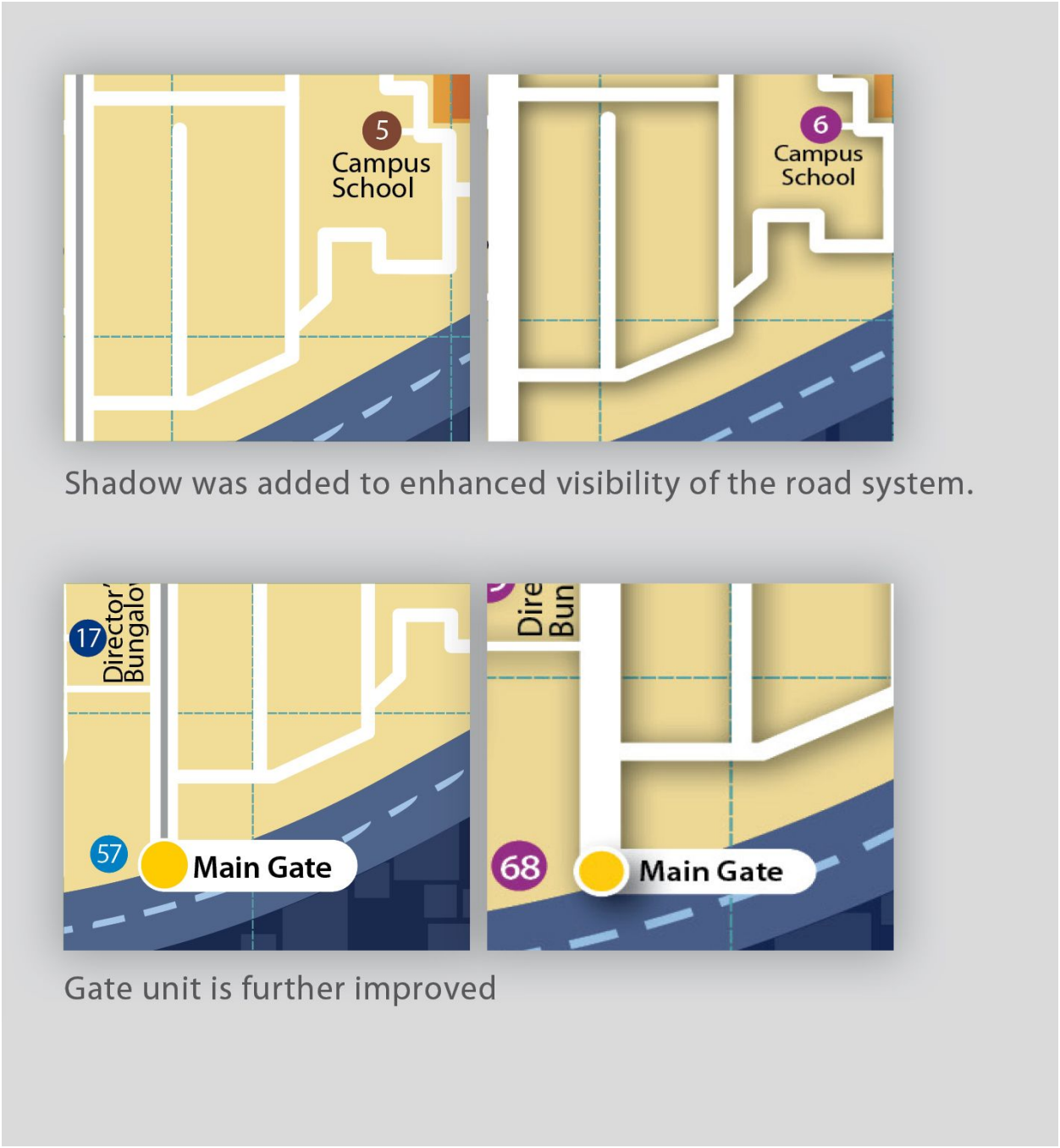

MICHIGAN STATE
UNIVERSITY
MIT Campus Map
Welcome to MIT
All MIT buildings are designated by numbers. Under this numbering system, a single room number serves to completely identify any location on the campus. In a typical room number, such as 7-121, the figure(s) preceding the hyphen gives the building number, the first number following the hyphen, the floor, and the last two numbers, the room.
Please refer to the building index on the reverse side of this map, if the room number is unknown.
An interactive map of MIT can be found at http://whereis.mit.edu/.
Parking
Lawrence Berkeley National Laboratory
SPRING GARDEN STREET
POWELTON AVENUE
FILBERT STREET
MARKET STREET
LUDLOW STREET
University of Massachusetts Amherst
Campus Map
July 2011
University Switchboard - (413) 545-0111
Tour Service - (413) 545-4237
Robsham Memorial Visitors Center - (413) 545-0306
STANFORD UNIVERSITY
VISITOR
INFORMATION
MAP
Boulder Creek
GRANDVIEW AVE.
MICHIGAN AVE
Pipe Line
Sports Ground
Girls' Hostel
Staff Hostel
Convocation Hall
Hospital

(Fig 7)

(Fig 8)

Initially roads were curved, mimicking the geographic reality of the campus. Later on they were straightened based on the following insights:
Even if the geographic reality (a bird's eye view of the road) indicates that the road is curved, a person walking on the road or driving down the road **perceives** it as straight. So roads were kept mostly straight (slight curvature in the road was dissolved on the map) unless an obvious turn was perceived (as in a left or right turn). This helped in reducing cognitive load[2]. The scale of map could have been conveyed in ratio, for example 1 cm stands for 100 meters. But we refrained from this because if someone scales this map while photocopying, it would have completely distorted distances. Therefore we have provided approximate walking time.

[2]Cognitive load: total amount of mental activity imposed on working memory at any instance in time.



(Fig 9)

Roads were left white against a cream background of the campus for adequate visual contrast. The idea was that people could draw their own paths on white roads. The map was redesigned such that it works when printed or photocopied in black and white.

A **shadow** was added to the entire road system, so that they are sufficiently separated from the campus land.

(Fig 10)

Locations: We chose to highlight certain locations where visitors are most likely to go such as Convocation hall, guesthouses such as Jal Vihar and Van Vihar. Photographs of important **landmarks** are included on the reverse side.

Numbering: Each location was given a unique number.

Circle was used as the container shape for holding location numbers because it occupies least surface area plus does not establish a visual relationship with other objects or circles on the map due to proximity.

Hostel naming and numbering: It was observed that people shorten longer names depending on frequency of use and for conversational ease. For example Hostel 4 is called H4 or even 4 at times. This habit was retained and hostels were given an alphanumeric code that is 'H' followed by the hostel number. Hostel codes were made visually distinct by colouring them orange. Students' hostels were treated differently compared to other locations on the map diagram due to the large number and high frequency of visitors accessing them (students outnumber other campus residents). One may argue that every relevant group could be given a distinct colour to speed up the search process. However giving each group of locations a unique colour code would create a visual chaos on the map diagram as well as the map key. Such a multi-coloured map will have insufficient contrast in black and white print or photocopy unless optimized for both coloured as well as B&W printing. While designing a a designer has to factor in multiple user requirements and user scenarios. Hence colour coding for groups of locations was done away with in the map key, but colour was retained in the map diagram. Why have coloured maps in the first place? Why not make it black and white? A map diagram with its multiple information layers may seem complex hence

uninviting. But complex need not mean complicated. "*Complexity is unavoidable, when it mirrors the complexity of the world or of the tasks that are being done, then it is excusable, understandable, and learnable. But when things are complicated, when the complexity is the result of poor design with completely arbitrary steps, with no apparent reason, then the result is perplexing, confusing and frustrating.*"(Norman, A.D. 2011). Colour adds a degree of persuasion, making coloured map more inviting compared to a black and white map when the information to be processed increases. Information and persuasion are no more opposite ends of the continuum of communication. "*Perhaps information / persuasion is not an "either / or" choice, but rather an "and / also" interaction between communication modes. There could be a complex interaction between the sender's intentions, message content, the audience/ user's motivations, the communications context, and the designer's strategies." (McCoy, Katherine. 2000)*

(Fig 11)
Certain locations which span a large area and have multiple entry points, were visually treated with a flat coloured patch as they are intersections and become critical decision making points for the map user. For example landmarks such as girls' hostel, Central Library, Victor Menezes Convention Centre and sports field. Locations like sports ground, plant nursery, Sarovar Udyan were painted green to indicate green cover.

(Fig 12)

Locations that are accessed in case of **emergency** such as hospital, medical store, ATMs have been given **icons** besides the location number, on the map diagram. Separating the icon and number into two elements makes unnecessary demands on people's map processing skills. Thus we integrated the two into a coherent unit. Other locations with icons include swimming pool, post office and temple. Icons give a quick overview of facilities/services available on campus at a glance.

IIT Campus has three **entry gates** (one of them seen in fig. 9). Most visitors enter through the main gate. Gates were given a distinct visual treatment; an attempt was made to make them stand out compared to rest of the campus.

Redesign Process: Map key

Now we come to the second part of this discussion- the map key. The biggest issue with the key in the old map was that sorting mechanism for locations was totally absent. But before one began to organize the location list it was important to investigate how people search for a place in the map key. We roamed the campus, observing how people find their way and found that typically map users would fall into two broad categories of first time visitor and campus regular.

One of the following scenarios would be true for a first time visitor:

1. Knows the location by name
   (map user uses alpha-numeric list to look up grid code and location number to find desired location provided he is aware of how grids and coordinate systems work)
2. Is looking for a particular auditorium but has only a vague memory of its name
   (map user looks up list of groups and checks auditorium category)
3. Is looking for restaurants/ eating joints but doesn't necessarily know their names or locations.
   (map user looks up eating places on list of groups)
4. Is looking to explore campus, looking for 'off the map' places of interest
   (visual icons will give a quick overview of places such as swimming pool and crocodiles near boat house)

One of the following scenarios would be true for a campus regular:

5. Knows his own department, wants to explore the area nearby
   (map user will look at the map and reverse search a particular location on the alpha-numeric list)

The portable IIT B map is a single solution attempting to cater to many people, that is a diverse audience. In print it is difficult to satisfy every scenario all the information layers are simultaneously present and everything can be seen upfront, at one go. In an electronic device however multiple users can be separated by providing a different login each. Also print has infinite space compared to the dynamic and infinite space of a digital device. Thus satisfying every scenario and factoring in the functional portability of the print map makes it more challenging over an interactive map.

As people have many ways and reasons for searching information, a two pronged design strategy was employed. Search by groups and search by alpha-numeric list. Having two lists meant a major space crunch. We ended up using Myriad Pro at point size 5, which till that point we considered a big no-no. But to our surprise it worked. This shattered one of our presumptions that no font can work at point size 5.

Location address in the map key should follow the sequence location name – grid code – location number. Shuffling this sequence would lead to tampering with map users' natural way of searching.

Overview of campus maps from around the world

(Fig 13)

Overview of 30 campus maps from around the world across parameters		
Map	Coloured	7
	Black and white	23
Entry Points	Yes	8
	No	22
Grid	Yes	19
	No	11
Grid Axes	X axis	Majority (13) plotted alphabets
	Y axis	Majority (13) plotted numbers
Background colours	Cream	7
	Green	6
	Blues/ Lavendars	4
	Light Greay	4
	White	2
Road colour	White	17
	Light grey	8
	Grey	4
	Others	1
Scale	Map to scale	13
	Map not to scale	17
Map key search	Alphabetical search	11
	Alphabetical and numerical search	3
	Alpha-numeric search	2
	Search by group	11
	No map key	3

(Fig 13.1)

Coloured or black and white?

Out of 30 campus maps reviewed, majority of maps, 23 to be precise are coloured. Amongst these Cream (30%) is the most commonly used background colour followed by Green (26%), Light grey and Blues/ Lavenders at an equal footing (17.5%) as well as White (9%). Of 7 Black and White maps, 6 use White as background colour.

Roads:
The most commonly used colour to represent roads is White (57%) followed by Light Grey (27%), Grey (13%) and others (3%, white outline and no fill on blue background).

Entry points:
Entry points are not distinctly shown in most maps (73%). 8 maps where entry points are distinctly shown use visual strategies such as long tailed arrow (UCLA), white text enclosed in rectangles and triangles (University of Reading), a triangular arrowhead without a tail (Rice University), a tunnel map (Northeastern University), triangles indicating entrances for people and triangle with a square indicating entrance for goods transportation (TU, Delft), arrow heads with in-turned tails (University of Leeds) and names (IIT Madras).

Grids:
63% of campus maps make use of an alpha-numeric grid on the map diagram. 68% campus maps had numbers plotted on Y axis and alphabets on X axis. A great variety of visual treatments are used to represent the grid. The reason behind this is perhaps to underline the use of grid to search a place on the map diagram. An act, which may seem common place to a seasoned map-reader but is completely alien to those not familiar with grids or coordinate system. Of all the representations of the grid which is the most appropriate and why?

Map key:
Of 30 maps that were reviewed, 3 had no map key at all and names were directly superimposed on the map diagram. Of the 27 maps that did have a map key, 11 allowed for an alphabetical search, 3 allowed for both alphabetical as well as numerical search, 2 allowed for an alpha-numeric search, 11 allowed for search within groups of locations and alphabetical search under each group.

Use of scale in the map:
Out of 30 maps, 13 were to scale while 17 were not to scale. A few maps mentioned distance between the campus and nearby landmarks like an airport or train station. No campus showed distances or walking/ driving times for navigation within the campus. Unlike India, in the context of western countries driving as opposed to walking or cycling

is the norm perhaps.

Findings:

IITB campus map redesign process has helped us arrive at certain findings about design of diagrammatic map and map key in campus map design.

Diagrammatic map and abstraction: It is preferable to abstract geographic reality because slighter curves in the road are perceived to be straight while walking. We found this when we asked people how they would go from point A to point B and most of the respondents said go straight. In geographic reality, the road from point A to B is curved. Thus diagrammatic map adds order to the organization of elements on the map compared to organic structure that exists in representation of geographic reality. A fine balance has to be maintained while abstracting the geographic reality so that distances don't look skewed (beyond point of recognition) in the map, which perhaps is the only drawback of abstract diagrammatic representations.

Diagrammatic map and visual syntax: Distinguishing variables such as colour, texture and shapes must be used carefully keeping in mind visual contrast of the map. Roads are best kept white on a cream background (landmass), as we found people drawing a path over white roads while guiding someone.

Use of grids reduces scan area on the diagram, making the search process faster. One cannot make a blanket statement about optimum number of grid divisions (we have used a 5 X 5 grid). However the number of grid divisions should be on the higher side such that dense areas are distributed into smaller search areas. Areas that will be accessed in case of emergency should be made into icons for a quick overview.

On Indian campuses people always ask for how far a place in terms of walking time not distances, therefore walking time accompanied with an icon of a person walking should be given a preference over distance (in km).

Map Key:

We introduced the use of two kinds of searches- search by groups and search by alpha-numeric list. This enabled 'reverse' search of a location that is from the diagram into the map key. An important realization beyond the nuances of design decisions themselves was that, a good map must have certain degree of learn-ability. After using it for a while, it should become redundant- unless a new need is felt for looking at it once again.

Limitations and future scope:

Diagrammatic strategy creates an order but distorts and skews distances. Such a map is not to scale. We plan to take this map forward and make an isometric, interactive and a bilingual version of it.