

1 Transforming the Engineering of Cities: ‘Points of Departure’  
2 for Future Visioning

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8

9 Abstract

10 There is growing recognition that urban design and planning practices are ill-equipped to deal  
11 with the challenges of the future. Given shifts in demographic patterns, the effects of climate  
12 change and economic uncertainty, there is a pressing need for alternative approaches to solve  
13 complex challenges and to craft new urban futures. If we are to envision futures, there needs  
14 to be a rigorous questioning of urban design and planning practices. From the findings of the  
15 Transforming the Engineering of Cities Program (TEC), an ambitious 5-year multi-disciplinary  
16 research program, we argue that there are three “points of departure” that can be employed  
17 in engineering cities for the future. They are starting points for thinking through how we  
18 approach crafting urban futures by: 1. ‘Re-thinking engineering principles and practice’ 2. ‘Re-  
19 imagining the function and form of the city itself’ and 3. ‘Understanding of the city as a social  
20 system.’ The implications of these departure points are ways to transform future visioning for  
21 projecting and crafting urban futures. [Office1]

22

## 23 I. Introduction

24 The purpose of this paper is to discuss lessons the Transforming the Engineering of Cities  
25 Program (TEC) program that can inform and equip the current context for engineering to  
26 envision and prepare for unknown futures. The TEC programme uses a multi-disciplinary  
27 approach to transform the engineering of cities for societal and planetary well-being within  
28 the context of low carbon living and resource security, using tools and approaches from  
29 disciplines such as engineering, public policy, psychology and economics.

30

31 The research programme has included 2 distinct phases. Phase 1 organized the team into 5  
32 thematic areas related to specific universities' projects of interests. This included: 1) city  
33 analysis 2) well-being 3) energy 4) policy, governance and economics 5) future visions.<sup>1</sup> Using  
34 high-level discussions, consultation and a mapping exercise to understand shared goals, there  
35 was a reorganization to frame the work of Phase 2 in a more interdisciplinary manner, using  
36 adopting the following themes: 1) Sharing City 2) Radical Mobilities City 3) The Ecosystem  
37 Serviced City 4) the Re- Zoned City 5) City of Synthesised Flows 6) Investing City and 7)  
38 Transforming the Liveability of Cities 7) Gendered City 8) Choreographing the City. Each of the  
39 phase two projects incorporated the multi-disciplinary expertise built in phase one, in order  
40 create more interdisciplinary projects. Identifying lessons to inform and equip the current  
41 context for engineering vision will draw upon work from Phase 2 of the research program.

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<sup>1</sup> The City Analysis theme aimed to understand the supply resources to cities. The wellbeing theme aimed to understand individual and societal wellbeing with particular attention to the aspirations and mobilities' aspects of urban life. The energy theme sought to understand the context for low-carbon energy supply and security. The policy, governance and economics themes looked closely at re-engineering the machinery of policy-making and re-envision of city financial models. Finally, future visions looked at how to develop future visions for liveable cities.

43 In reviewing the work of Phase 2, this paper asks the question “*what lessons from the TEC*  
44 *programme can inform and equip the profession in approaching challenges and crafting urban*  
45 *futures?*” There are a numerous specific findings from the research programme, but this  
46 paper focuses on a meta- analysis of the programme to discuss the implications of findings  
47 for engineering practice across all the various contributions. We delineate three 'departure  
48 points' for conceptualizing urban futures that emerge when reviewing outputs of the project.  
49 They are:

- 50 1. Re-thinking engineering principles and practice (designer focused)
- 51 2. Re-imagining the function and form of the city itself (urban design focus)
- 52 3. Understanding of the city as a social system (user focused)

53 This paper includes these three points of departure for envisioning futures featuring examples  
54 from the TEC program. These case studies contribute to a discussion of how urban futures are  
55 currently crafted (Hanson, 2015). This paper aims to contribute the the strengths of these  
56 departure points and the implications of applying these for urban engineering futures.

57

## 58 II. Method

59 The TEC program produced 10 white papers which provide insights and alternative  
60 approaches intended for a policy and design audience based on the research of the individual  
61 research streams. For a full list and references to the white papers, please refer to the  
62 References. These white papers were written for a policy audience and treated here as  
63 primary evidence from the research streams.

64

65 For the purpose of this paper, the white papers were reviewed to identify core aims, insights,  
66 alternative scenarios and best practices to inform new forms of projecting and crafting urban  
67 futures. Then, using a grounded theory approach, findings from the white papers (aims,  
68 insights, scenarios and best practices) were grouped according to common themes that  
69 emerged. This approach to grouping the themes was conducted by two researchers in order  
70 compare and to probe any differences in the themes that might arise. The subsequent  
71 sections will discuss the results from the TEC program through the lens of points of departure  
72 and their implications for *“lessons from the TEC programme that can inform and equip*  
73 *approaches to tackle challenges in, project and craft urban futures.?”*

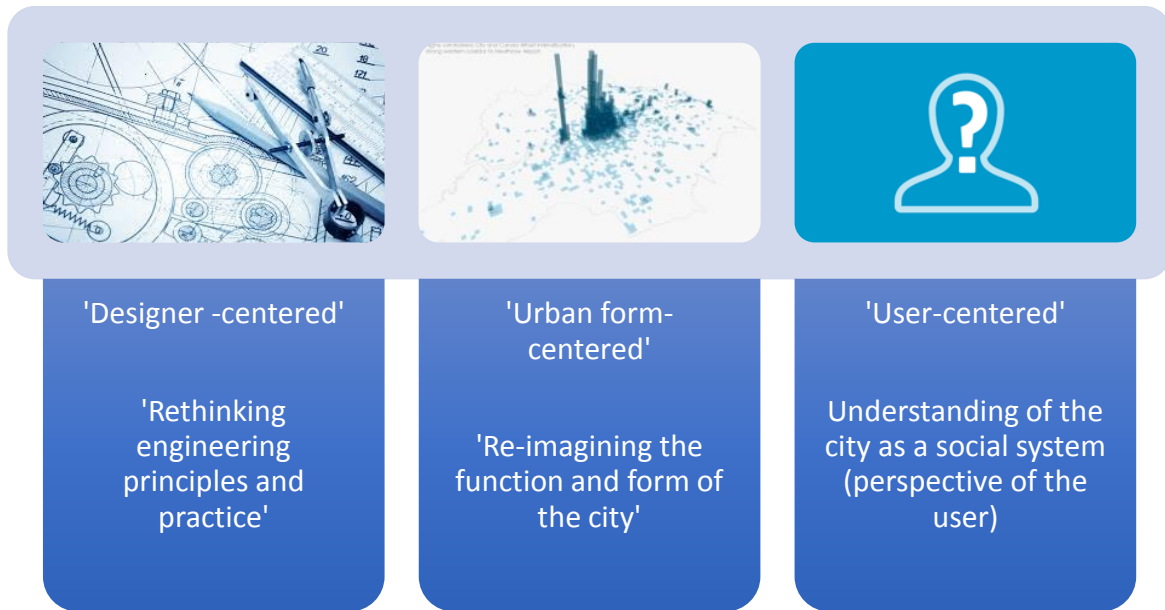
### 74 III. Results

75 The main finding of this analysis was evidence of three typologies for differences in the  
76 “points of departure” when researching the future of cities. These points of departure can  
77 be understood as starting points for how we might rethink the engineering and design of  
78 cities. The point of departure is of significance because it frames the stage at which the  
79 intervention is applied and where changes in current thinking begin (or depart from) as  
80 featured in ‘

81 Figure 1 Points of departureFigure 1 Points of departure.'

82

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85

86

87 Applying this to tackle a problem provides three departure points from which to choose. If  
88 approaching a problem such as congestion for example, , an intervention or 'solution' would  
89 yield different perspectives depending on whether the point of departure is designer-  
90 centered, urban form centered or user-centered. While not explored in this paper, the  
91 outcomes from the respective point of departure would not necessarily be the same given a  
92 difference in point of departure. However, as shown in 'Figure 2: Applying departure points  
93 to an urban challenge', thinking through which starting point, provides an awareness of the  
94 points of departure relative to a desired outcome. Table 1: Points of Departure in TEC  
95 projectsTable 1: Points of Departure in TEC projectsTable 1Points of Departure in TEC projects  
96 provides the results of this identifying points of departure in the current TEC projects from  
97 Phase 2.

98








101

102



Table 1: Points of Departure in TEC projects

Point of Departure	Project Examples	Aims	Alternative approaches include:
<b>Designer-centred</b> <b>“Rethinking engineering principles and practice”</b> 	<b>1. UK City Life (CAM), University of Birmingham</b>	The UK City LIFE, “CAM” aims to incorporate social metrics within an indicator-based metric in order to assist councils in understanding how their city is performing.	Contributing a comprehensive assessment to assist councils in understanding how their city is performing, to develop and operationalize activities to achieve the city’s future visions
	<b>2. Urban principles and pathways for future city vision, University College London</b>	Through sectoral visioning workshops in 8 cities in the UK, this project engaged stakeholders for urban projects, policymakers and civil society in a creative process of crafting a vision.	Beginning with a high level vision (evidence from transformative behaviors often with political leadership/strong participatory processes) and high level imaginaries.
	<b>3. Choreographing the city, University College of London</b>	To develop a concept where engineers and choreographers explore what they may learn from one another about design approaches.	Taking into account the different approaches and similarities to space that choreography and engineering bring (ie. both practices deal with curating space, form and flow)
	<b>4. Governance of Smart Cities , University College of London</b>	This aims to explore mechanisms for urban innovators to leverage city government data to progress their ideas, projects and businesses taking into account fundamental characteristics of a smart city.	Demystifying opportunities for tech innovators to leverage and navigate governance systems to Progress their innovations, setting out recommendations to local government about how they facilitate the tech market to meet agendas.
<b>Urban form centred</b> <b>“Reimagining the function and form of a city”</b> 	<b>1. Sharing City, University of Lancaster</b>	It aims to make visible the ways in which sharing is arranged through a series of workshops with citizens of Lancaster and Birmingham and creating a typology, focusing on sharing in cities.	Different dimensions of sharing and models of sharing, methods for designing communication platforms that integrate the different dimensions and actors of sharing in localized conversations
	<b>2. Contribution of urban metabolism in transforming the engineering of cities for global and societal well-being, University of Southampton</b>	This project aims to offer insight and highlight how cities work in terms of the resources that flow through, the wastes they produce and structures they build.	Improving links between urban metabolism and life cycle analysis, taking into account scales of governance and frameworks for for sustainability, climate change, and low carbon living
	<b>3. ‘Car-free’ City, University of Birmingham</b>	The “car free city” is a project that aims to provide evidence to promote the elimination of cars in cities. This approach reimagines a city by “(re)designing an alternative to what has been called an ‘autopia’.	Providing alternative scenarios for how people live and work and interact to alter energy consumption profiles and shifting towards decentralized electricity networks and local energy consumption.
<b>User-centred design</b> <b>“Reimagining the function and form of a city”</b> 	<b>1. UK City Dweller Aspirations for Cities for the Future and for Themselves: a study of London and Birmingham, University College London</b>	Aims to inform policy and practice to promote wellbeing and reduce carbon by looking closely at what city-dwellers want for themselves in order to assess what they aspire to for their lives.	Providing evidence to support the synergy between carbon reduction initiatives and individual well-being, promoting communal ways of living, spaces that are family-friendly and community-friendly and other connection strong aspects.
	<b>2. Designing for Well-being in Birmingham, Lancaster and Southampton</b>	This project aims to address a gap in research looking at the combination of deprivation, population density and well-being in Birmingham.	Applying an inclusive approach to urban planning, designing and policy making for enabling wellbeing in cities

1            *1. Re-thinking engineering principles and practice (Designer-centered)*



2  
3        In this point of departure, an approach for crafting urban futures begins with examining how  
4        the designer thinks about the process itself, what views and knowledge he/she is they are  
5        building upon and how this informs processes for decision-making and planning.

6  
7        The case studies from the TEC program that apply this point of departure in Table 1 challenge  
8        engineering and design thinking in different ways. In one project, the designer includes social  
9        metrics within indicators. In another, the designer positions future visioning as an ongoing,  
10       dynamic and people-centered process and in other examples, the designer provides  
11       alternative views to the normative ways in which designers interact in the cities they are  
12       designing. The following section will discuss the implications of applying this type of thinking  
13       in engineering practice.

14       *Implications of applying the designer-centered centred point of departure*

15       *1.1 “Social metrics are incorporated in decision-making”: The UK City Life*

16       The UK City Life project suggests a need for a shift in engineering thinking by changing the  
17       tools designers use to measure and determine solutions. The implication of this type of  
18       thinking is that social metrics are incorporated in the tools (indicators) that the engineer (or  
19       other designer) uses to inform decision-making.

20

21 As indicators are one of the ways in which designers measure performance in cities to inform  
22 decision-making, the indicators chosen and applied depend on the principles and perspective  
23 of the designer and institutions that employ them. This example also suggests an alternative  
24 approach that would “put social metrics alongside “green indicators” (Leach, n.d.). The  
25 implications of this approach is that designers shift core principles in engineering through  
26 inclusion of social metrics. This can be applied in a variety of ways that include: decision  
27 making frameworks for policy, city performance targets for future city visions and/or trend  
28 analysis of social metrics in green indicators over time.

### 29 *1.2 “Visioning as a process”: Urban Principles and Pathways for Future Visions*

30 The Future Visions project proposes as series of urban principles and pathways that shift  
31 future visioning from a stage in a design process to an ongoing process, from a static process  
32 to a dynamic process and from an institution-centered approach to a people-centered (end  
33 user) approach. The effect of this point of departure is that it shifts engineering principles  
34 around visioning as a step at the ideation and design stage towards an ongoing component  
35 of a design process - transforming the vision for what engineering should achieve. The  
36 researchers describe this as *“transforming [the] core frameworks and processes for the  
37 engineering of cities including planning approaches and tools”* (Tyler, Nick, Ortegon, n.d.). A  
38 shift in engineering practice would mean using processes that are not static (i.e. a one-off  
39 consultation, a public inquiry). Instead they would be dynamic processes (ongoing) that  
40 moves away from the static view of visioning and can build capacity as change occurs. As a  
41 constant process it is also constant in its inclusivity and through prioritization of these high  
42 level principles that shift away from how visioning is currently done.

43

44 The implications of this point of departure would mean that as it is not driven by the needs,  
45 wants and aspirations interests of the dominant group, it is open to views from among  
46 seemingly disparate stakeholder groups. Applying this point of departure moves beyond  
47 competing intermediate interests through a set of high level principles that is integrated at  
48 every step of design, planning and implementation.

49

50 Another implication of this typology is that it transforms the position of 'visioning' in  
51 engineering altogether. It positions visioning as a form of 'engineering change' in a city in a  
52 way that *"promotes transformative action as the vision does not end with the definition of*  
53 *urban principles, it begins there"* (Tyler and, Nick, Ortegon, n.d.)

54

### 55 *1.3 "Inclusion of a social justice oriented approach": The Gender perspective*

56 The gender perspective research group applies the designer-centered departure point  
57 because it aims to transform how the designer thinks about the process, knowledge and  
58 perspectives used which has implications for how decision-making is made, how design is  
59 taught and approaches used in practice. It is proposed in the text that achieves this through  
60 the inclusion of a gender lens in engineering practice and education (Cosgrave, n.d.).

61 The implications of applying this point of departure is that it proposes a transition from the  
62 current state of engineering education and professional practice to a more social justice  
63 oriented approach. This could take the form of a gender agenda that includes knowledge,  
64 capacity building and incentives to create more inclusive outcomes in engineering  
65 institutions. An application of this agenda might include for example "examining the lifecycle  
66 of an engineer's academic and professional development as well as the lifecycle of

67 engineering projects in order to develop a knowledge base that from the beginning is  
68 designed to incorporate a gender lens” (Cosgrave, n.d.). The implications of including this  
69 point of departure is that it incorporates a gender lens that values women’s experiences  
70 which contributes towards a social justice oriented approach that can transform the role of  
71 engineering institutions.

#### 72 *1.4 “Highlighting blinds-pots within complex environments”: Choreographing the city*

73 In this study, the researchers examine the differential mechanisms employed by engineers  
74 and choreographers to understand, notate (sketch, map or describe) an intervention for a  
75 public space such as a train station. Whilst still in the exploratory phase, the researchers have  
76 found emerging themes including: improvisation as a tool to simultaneously develop and  
77 refine ideas in real-time; ‘Thinking with the body’- whereas knowledge in engineering is  
78 developed through observation and communicated in written form, choreographers develop  
79 and communicate ideas by experiencing and inducing physical responses; and ‘qualitative  
80 notation’- whereas engineers have models to represent volumes and distribution of  
81 movement through the city, choreographic notation includes ways to describe the qualities  
82 of movement.

83

84 The implications of this insight is that by understanding the worldview of another discipline,  
85 and translating this to the engineering of cities, designers can highlight blind spots for  
86 addressing complex challenges where current approaches are insufficient to deal with  
87 complex aspects of urban design. If incorporated as a standard practice, this could contribute  
88 to new ways of thinking about engineering principles and practice.

89

90 The projects that originate from this point of departure have found that engineering futures  
91 must be: more socially oriented;, process- focused and adopt radically different world views.  
92 This point of departure places the starting point for transforming the engineering of cities  
93 with the principles and practice within engineering institutions and the processes that they  
94 engender. From these examples, there are also a set of actions that emerge in considering  
95 what “transformed” approaches described in this departure point are achieving. They are:

96

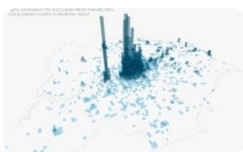
- 97 1. Placing social metrics alongside “green indicators
- 98 2. Moving away from the static view of visioning
- 99 3. Envisioning what engineering should achieve
- 100 4. Applying more social justice oriented approach
- 101 5. Understanding how different lenses and perspectives from other disciplines might  
102 highlight blind spots for addressing complex challenges. |

103 [Office2]

104 These examples show the ways in which the principles and practice from the perspective of  
105 the designer have the potential to transform the agenda of engineering solutions. The next  
106 section will describe examples of projects where the departure point begins not with the  
107 designer, but with the urban form itself.

108

## 109 2. *Re-imagining the function and form of the city (urban form)*



110

111 Beginning with a city's form and how it functions as the starting point for solving an urban  
112 problem introduces a different point of departure. This point of departure highlights a feature  
113 (a caricature) of the city where an alternative future (i.e. A car-free city) may be desired or  
114 explores an innovation existing feature (i.e. Smart cities) in order to draw attention to other  
115 sectors where it could benefit from added engagement (i.e. Transport and smart technology)  
116 or disruptions that that may underlie challenges in governance. In either of these cases, this  
117 point of departure provides a bird's eye view of the end product, the urban form.

118

119 With a focus on the function and form of the city, this distinctly "product" focused approach  
120 involves the designer, but starts with the desired form or the outcome the city should deliver.  
121 If we understand a caricature as a feature that is exaggerated, it can be conceptualised  
122 beginning with that desired form or outcome (i.e. 'Car-free' or 'smart' city). If the outcome is  
123 a city without cars, a "car-free" design would be the desired form, or "caricature", of the city  
124 that would guide future planning efforts. If the outcome is "smart", that would be a desired  
125 outcome, or another "caricature" of the city that might help to align groups with a similar  
126 interest in smart cities. The usefulness of this approach is that it magnifies a feature to orient  
127 visioning towards a particular effort, draw together similar interest groups and promote an  
128 approach to analysis that highlights how and where a 'caricature' interacts with other  
129 elements of the city system.

130

131 This point of departure can include caricatures specific to a process in addition to an  
132 alternative form or an aspect of an existing form as discussed previously. A process can be  
133 flows (ie. Energy) and/or metabolism (ie. Waste pathways) within the city. This example

134 would provide a bird's eye view of the city with particular attention to one or more features  
135 of a process and how it interacts with different aspects of the city. The result is a magnification  
136 of how this particular element interacts with the rest of the city system and therefore reveal  
137 its significance or role in greater detail. is that the outcome for the city is based on "a  
138 caricatures of a city" that makes a particular feature big to reveal thinking that would "turn  
139 the idea of how we understand the city if it was..."

140

141 *Implications for of applying this point of departure*

142 *2.1 "Promoting a closer look": Sharing city*

143 In thinking about the 'sharing economy' as it exists currently within the city and the desired  
144 form or "product" so to speak, this study useding interactive tools such as local maps and  
145 interactive workshops to radically shift how city-dwellers participate in discussing their views  
146 of the sharing city and in how they would like to see it constructed. This included "1) the use  
147 of design orienting scenarios as a result of and to further social conversations about possible  
148 futures beginning with the desired form and function of the city and 2) mapping local actors  
149 to understand existing promising examples that transform what happens currently on a small,  
150 disconnected scale from what is detached from alternative visions of what the city for the  
151 future requires. (Pollastri, Serena, Boyko, Christopher, Clune, Stephen, Cooper, Rachel,  
152 Coulton, Claire, Dunn, n.d.)[Office3]."

153

154 Applying this point of departure with the desired form of how the sharing city should be  
155 constructed may inform engineering practice by providing a examples of scalable processes  
156 for co-creating the sharing city. Similar to the future visioning workshops, the experiences of



157 the stakeholders involved in the production of the sharing city provide insight on the  
158 importance of the participatory nature of city building.

## 159 *2.2 “Leveraging mechanisms for governing cities in the digital age”: Delivering the Smart City*

160 By examining the role of governance for smart cities, this project highlights the opportunities  
161 opportunities available now for tech innovators to leverage and navigate governance systems  
162 as well a set of actions (i.e. taking ownership, clarifying opportunities) to guide local  
163 government in how they incorporate the changes in tech to meet their own agendas.

164 Findings from this study apply the departure point by highlighting an existing feature, a  
165 caricature, which is the smart city. By acknowledging that the “smart city is here”, “cities are  
166 spending” on the smart city, the findings suggest that in order to optimise maximise the  
167 opportunities of the smart city, cities will have to begin with the existing form of the smart  
168 city and adapt. For cities of the future, *“local authorities must develop a capability to plan  
169 strategically for urban innovation as well as respond to disruptive innovations as they hit the  
170 market”* (Cosgrave & Doody, 2014). The point of departure here is in recognising the current  
171 state of the smart city where it is now and taking smart steps to govern in the digital age. The  
172 implications of the smart city as the point of departure is that in theory, there is a  
173 requirement of local governments to accept the pace of change and to take ownership in  
174 crafting a vision for innovation in their cities. In practical terms this might for example  
175 suggestinvolve for example, investing in programmes for innovation in their cities, supporting  
176 city labs and smart city networks and supporting infrastructure for sharing data within the  
177 city. By drawing attention to a perspective on the form and function of the city, this point of  
178 departure suggests policy and investment direction will be a function of the existing form of  
179 the smart city and the vision for it in the future.

180

181 *2.3 “Processes for a flows in a city understanding the nature of complexity”: urban metabolism*

182 Highlighting processes in a city is another way in which the form and function of a city can be  
183 applied as a point of departure. Processes of ‘urban metabolism’ apply the urban form  
184 departure point by highlighting how cities work in terms of the resources that flow through  
185 it, the wastes they produce and structures needed to deliver them. By starting with how flows  
186 operate within the urban form, this study uses this point of departure to shed light on areas  
187 where more attention may be needed. Due to the complexity of these systems, there is added  
188 attention on the following to ensure conclusions based on studies of flows are robust: scale,  
189 networks, data availability, complexity, life cycle, internal flows (Lee & Bouch, 2016).

190

191 The implications of this departure point is that by narrowing a focus in order to confront the  
192 complexity surrounding flows in modern (ie. resource and waste) cities, there is detailed  
193 attention to one system but taking into consideration how it might affect and be affected by  
194 other systems. This shifts thinking from a sectoral, top-down approach to thinking to one that  
195 is wide and holistic while maintaining a focus on a specific process-related challenge facing  
196 cities. With a focus on resources or waste, this point of departure highlights how these flows  
197 interact with the social and economic aspects of the city. In this case, highlighting a feature  
198 like metabolism renders the complexity within the city more apparent by drawing attention  
199 to a series of approaches that deal with scale, networks, data, complexity, life cycle and  
200 internal flows in order to best design an urban form that is fit for purpose.

201

202 2.4 “Designs for a findingIdentifying cracks in a city”: “car-free city”

203 Examples where a desired form of a city, such as the car-free city, are applied as the point of  
204 departure contribute to insights on a range of challenges (technological, economic,  
205 organisational and social) that would be needed to ‘engineer’ a post-car system. Even though  
206 there is not evidence of a complete car-free city, this “thought exercise” (of what it would  
207 take to have an urban form that is designed for other non-motorised modes) contributes to  
208 an understanding that there are “no silver bullets for energy in cities” (Urry, n.d.)<sup>[Office4]</sup>. What  
209 this point of departure provides in addition to a system design insights, this point of  
210 departure offers, is a map that ‘identifies cracks’ in the system; that if overcome or “cracked”  
211 can contribute to other car-free initiatives.

212

213 The implications of this point of departure would use thinking through the way the layout of  
214 a city for cars influences how people live, work and interact as a starting point towards  
215 crafting a vision for the city and how it would have to be designed to achieve that vision. This  
216 understanding would be needed for example, in order to alter energy consumption profiles  
217 towards decentralized electricity networks and local energy consumption which would be a  
218 context required for a car-free future. This understanding would also “require understanding  
219 the functions of a city designed for cars in order to best facilitate a transition towards an  
220 interactive, citizen friendly, smart city whose functions are in line with that form.”<sup>[Office5]</sup>

221

222 Applying the departure point of the urban form provides opportunities to highlight existing  
223 characteristics at a city level (i.e. in urban metabolism, sharing city, smart city), desired futures  
224 and barriers that need to be overcome to achieve them (car-free) and roadmaps for orienting

225 designs, processes and mechanisms for governance in order to achieve a vision for the urban  
226 form.

### 227 *3. User-centered design*



228  
229 This typology begins first with the user and information communicated by the user on  
230 his/her/their needs that includes perspectives related to what is required to best meet those  
231 needs. This departs from traditional engineering practice which views people as nodes,  
232 shaped by their surroundings that can be categorized, rather than messy, complexities that  
233 have needs, wants and aspirations which shape and are shaped by surroundings.

234

#### 235 *Implications of applying this typology*

##### 236 *3.1 "Human-centered approaches": UK City-Dweller Aspirations for Cities*

237 There were several findings from the study on aspirations of youth in cities that provide an  
238 evidence base for collective living and design. This study applies a departure point beginning  
239 with the user's aspirations. For example, the evidence base for collective living and design is  
240 informed by a desire from users' for spaces where connection is paramount (i.e. communal  
241 ways of living, spaces that are family-friendly and community-friendly). There was also  
242 evidence that was less expected such as desire for social connectedness and security in  
243 connection with a nostalgia for the past (Joffe, Helene and, Zeeb, n.d.)<sup>[Office6]</sup>. The  
244 implications of findings related to this point of departure are that it leads to

245 recommendations that are informed by a human centered approach and thus can account for  
246 actions that combine carbon reduction initiatives and individual well-being.

247 Further implications of this point of departure is that in using city-dwellers' aspirations  
248 iteratively aspirations iteratively in practice, it can contribute to planning that integrates  
249 personal well-being and aspirations as core engineering principles.

250

### 251 *3.2 "Designing for well-being": a comparative study of Birmingham, Lancaster and* 252 *Southampton*

253 This study on deprivation and density applied the user-centred point of departure by looking  
254 at how users perceive they are situated in an urban context. Findings that suggested that  
255 people living in high density/high deprivation perceived themselves as having fairly good  
256 mental health and optimism for the recent future in communities of people living high  
257 density/high deprivation areas despite perceiving their general health as being quite poor.  
258 Nonetheless, they exhibited dissatisfaction with the physical setting and safety afforded by  
259 their neighborhood (Rajendran, Lakshmi Priya, Boyko, n.d.)<sup>[Office7]</sup>. The implications of this  
260 applying this departure point is that it incorporates the experience of the users in areas of  
261 density and deprivation in understanding the relationship between wellbeing and low carbon  
262 initiatives in cities.

263

264 Other Another implication ns of these findings is is that it can transform how interventions  
265 are prioritized in a planning context from a user-perspective. Applying this finding from this  
266 point of departure might inform planning by highlighting that people in neighborhoods that  
267 have high density/high deprivation are not necessarily the ones whose residents have the

268 lowest levels of well-being. Findings like this can direct investment towards areas that need  
 269 it most. In this example, interventions may be directed towards safety and the physical setting  
 270 rather than efforts to improve emotional well-being. More broadly, the implication of this  
 271 point of departure is that it challenges engineers and planners to think about commonly faced  
 272 problems such environmental quality with the user’s perspective.

273 **IV. Discussion**

274 The three points of departure: designer, urban form and the user perspective provide  
 275 different ways for thinking about transforming engineering practice. Each of these points of  
 276 departure prioritize different concepts as the reference point though they likely incorporate  
 277 aspects of the other points of departure: the principles and practice ‘designer’ approach  
 278 prioritising/prioritizing application critique of engineering principles, placing the pivot for  
 279 transforming practice with the designer. In these examples, that is the engineer. In the ‘urban  
 280 form’ approach, the existing or desired form, function or process in the city is the starting  
 281 point. This prioritizes an aspect as it relates to the end product that the city should deliver  
 282 (i.e. A smart city, a sharing city, a car-free city). The third point of departure prioritizes the  
 283 needs and wants of the user and places his/hers/their needs, wants and aspirations (actual  
 284 and/or perceived) at the center of the problem-solving process.

285

Designer	Urban Form	User
Placing social metrics alongside “green indicators	Promoting a closer look	Human-centered approaches
Moving away from the static view of visioning	Leveraging mechanisms for governing cities	Designing for well-being
Envisioning what engineering should achieve	understanding the nature of complexity	
Applying more social justice oriented approach	Identifying cracks in a city	
Understanding how different lenses and perspectives from other disciplines might highlight		

286

287 The ideal vision that emerges from considering each of these points of departure is that a  
 288 transformed approach in engineering practice would involve altering core fundamental  
 289 principles in engineering. This would suggest that techniques to understand ‘aspirations’ and  
 290 ‘visioning’ would be a core component of a rigorous process in engineering. This would lead  
 291 to a methodical way of investigating these aspects as standards in training and practice, with  
 292 attention to the different stages in a design process where a particular point of departure is  
 293 fit for purpose. The following section will discuss implications and strengths of applying these  
 294 different three point of departure jointly and simultaneously.

295

296 *1. Implications of each of these points of departure*

297 A strength of the designer-centered point of departure is that it is likely to have a time horizon  
 298 that is relatively long compared to the other departure points. The strength of this is that  
 299 radical approaches to design may have profound impact on the way in which practitioners  
 300 train and think about engineering problems. Similarly, with a long horizon, the opportunity to  
 301 shift how we think about the process of problem-solving can also adapt. In the example of  
 302 the future visioning workshops and breakfasts, if applied as a core component of engineering  
 303 practice may improve how designers conduct a process of vision building together with a  
 304 variety of stakeholders.

305

306 The implications of applying this departure point is that it has the opportunity to  
 307 constructively critique engineering practice based on its past performance and lessons

308 learned while also suggesting that the metrics and processes for planning and evaluating are  
309 areas where key stakeholders can make adjustments. Places where this critique could  
310 transform practice could range from pedagogy and teaching, policy and advisory and in  
311 practice.

312

313 A strength of the urban form point of departure is that it is a space where innovations can be  
314 trialed and challenged in real time either through highlighting aspects of existing urban forms  
315 or conducting scenarios for alternative futures. As it is a departure point that recognizes that  
316 there are several possible ways to interpret features of a city (ie. Smart city, sharing city etc.).  
317 Using the example of a “smart city” that has green growth model, a departure point focusing  
318 on urban form could be one designed to be car-free, yet it could also be one designed for  
319 autonomous, electric vehicles.

320

321 The implications of the findings for this departure point is that if a particular form and function  
322 is taken into account without the relevant stakeholders, there may be innovation in one area  
323 of engineering (i.e. Car-free designs for cities and/or new methods for sharing in cities) that  
324 may hinder progress in another area. For example, a car-free designs that remove vehicles  
325 without a holistic approach to planning, may result in disrupted local economies and/or  
326 labour markets. Nonetheless, because the time horizon for these types of interventions can  
327 range from short-term to long-term, there are several opportunities to highlight one feature  
328 and monitor its perceived and actual impact and evaluate influence on other areas.

329



330 The strength of the user-centered point of departure is that with the user at the center there  
331 are several opportunities to engage in the process of designs and policy recommendations  
332 that are reflective of user's perceived needs and wants. There is also greater likelihood of  
333 appropriation of the intervention by local communities. In the example of the UK City Dweller  
334 Aspirations' study, a focus on the user led to results in recommendations for future planning  
335 based on the aspirations and stated concerns with how young people view their city. In this  
336 example, the user is one of several stakeholders to take into account.

337

338 The implications of applying this departure point is that it radically shifts the problem-solving  
339 away from the designer and towards solutions driven by and for the user. This also introduces  
340 the reality that solutions have to be dynamic and adapt to a reality where user's needs and  
341 wants may change. The implications of this approach is that it also contributes to a  
342 recognition of the complexity, dynamism and 'messiness' of human and societal change with  
343 practice and design-making itself. While beyond the scope of this paper, this is discussed in  
344 the white papers as both a strength and a constraint.

345

## 346 *2. Opportunities for transformation; applying these departure points*

347 The implications of these different departure as a group is they together they highlight the  
348 possible opportunities to transform the engineering of cities and to promote societal well-  
349 being from three perspectives that are already being employed in crafting future efforts.  
350 What this paper aims to achieve is to emphasize the implications of recognizing these  
351 departure points and raise awareness of strengths of perspectives that may be overlooked  
352 due to conventions in engineering design and practice.

353

354 Considering the implications of each approach also highlights limitations for each one. The  
355 limitation for the designer focus are that it can replicate good practices that are based on  
356 sound evidence, yet may not be fit for purpose for a dynamic city and changing population.  
357 The limitations for an urban form focus are that without holistic input from the range of  
358 different stakeholders, it may not be fit-for-purpose for all groups, and in worse case  
359 scenarios, may prove disruptive. The limitations of the user focused approach is that without  
360 a holistic view of how different users interact with each other, the city as it is changing etc. it  
361 may not address the range of different users. In fact, it may perpetuate inequalities related  
362 to provision of services and/or resources designed for a particular user group. One may to  
363 mitigate a limitation of one point of departure by considering where the strengths of another  
364 point of departure. For example, a user-centered approach might help overcome barriers in  
365 a solution where an urban form point of departure is strongest (for example in 'designing a  
366 car-free city' including lessons from a user-centered point of departure).

367

368 Taking these limitations into account, there is a recognition of the strengths and implications  
369 discussed previously when one or more of these different departure points are taken into  
370 account. What happens when each of these departure points is incorporated at the starting  
371 block? To some extent, each of these projects include input from each of these themes, but  
372 what would a project look like when each of these departure points are used at the stage of  
373 understanding the problem?

374

375 The project that looked at designing for well-being in Lancaster, Birmingham in Southampton  
376 (insert cross-reference) may be achieved by understanding how users from areas with varying  
377 levels of deprivation and environmental sustainability perceived their well-being. The concept  
378 behind this approach is that from a design perspective, it should be designed with these core  
379 components at the center (3.2 “Designing for well-being”: a comparative study of  
380 Birmingham, Lancaster and Southampton “Designing for well-being”: a comparative study of  
381 Birmingham, Lancaster and Southampton).

## 382 VII. Conclusions and recommendations

383 In analyzing interventions designed to transform the engineering of cities for societal and  
384 planetary well-being yielded a typology and a process for recognizing points of departure that  
385 as part of future practice in engineering, can better inform the process for designing a  
386 solution. The examples from the Liveable Cities’ [Office9] project programme demonstrate that  
387 there are differences in points of departure of the different projects, which invariably, may  
388 reflect differences in how problems are approached and understood. While beyond the scope  
389 of this paper, it is likely that the differences in outcomes will vary based on the point of  
390 departure applied, though there may be other contextual factors to consider in that type of  
391 analysis.

392

393 These departure points operate with implications that may be more profound over the long-  
394 term (i.e. Principles and practice for engineering) or short-term (user-centered interventions)  
395 and require different processes for engaging with a range of different stakeholders depending  
396 on the nature of the problem they are looking to solve. Taking these into account requires an

397 awareness and understanding of which point of departure features most prominently and  
398 using that as a baseline for assessing strengths, limitations and what features of other  
399 departure points may be applied to inform a project approach.

400

401

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