Morphogenetic analysis of architectural elements within the townscape

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Revised version received 24 November 2014

Abstract. *When a new form is inserted in an existing townscape, its consonance within the urban fabric is dependent on the level of attention paid to the evaluation and management of its architectural elements. However, despite the established principles and methods of urban morphology that enable the systematic analysis of the built environment, a formula for ensuring that new development relates to its context so as to achieve congruent outcomes is still lacking. This paper proposes a new method of evaluating and measuring architectural elements within evolving urban forms, with particular emphasis on a three-dimensional study of buildings. In a case study, detailed mapping of both current and past forms provides the basis for evincing predominant characteristics that have changed over time. Using this method, it is possible to demonstrate objectively how the townscape has been affected through changes in its architectural configuration.*

Keywords: townscape, morphogenesis, streetscape, architectural elements, syntax

> Towns have a life history. Their development, together with the cultural history of the region in which they lie, is written deeply into the outline and fabric of their built-up areas (Conzen, 1960, p. 6).

Cities are characterized by growth patterns in which incremental and often small-scale developments aggregate in the complex rich patina of the townscape. Two important aspects affect the morphological transformation of the townscape: first, its spatial system (the spaces and uses within its plan configuration); and secondly, the physical fabric (architectural characteristics). In particular, building envelopes with differences in their façades, heights, setbacks, structures, openings and materials combine in various arrangements in the formation of a streetscape.

The aim of this paper is to relate the evaluation of architectural elements of individual buildings within past and present streetscapes to a syntax that articulates parameters for new urban forms. It is anticipated that the architectural detail of new design projects, drawn from the criteria coded in the syntax, will be imbued with values, measurements and characteristics similar to those in the existing townscape.

Appreciation of variations in the geometry and other aspects of the character of different building styles is important in enabling differentiation of individual building metrics related to architectural form. The analytical approach to the evolutionary aspects of historical urban form first established by Conzen (1960), and developed by the British school of urban morphology (Larkham, 2006; Moudon, 1997; Whitehand, 2001), provides a methodological framework for studying the prominent architectural elements of individual buildings at the micromorphological scale

  ISSN 1027-4278

(Larkham, 2006).

Very little new urban architecture is systematically designed to conform to morphologically informed criteria. At best it is created by those who apply an instinctive appreciation of urban context in their design process (Hall and Sanders, 2010). Consequently, there remains little suggestion of how to extrapolate morphological data into either a tool for evaluation, or a method of design. Larkham (2005), in responding to the question 'why bother with morphology?', states that 'some of our most significant urban problems of the last century have arisen in cases where new urban and architectural forms have been developed at speed and to a large scale, but with little or no reference to existing urban form and context'. MacCormac (1994) highlighted the disjunction of much modern planning and development. The incongruity that characterizes much contemporary development is a direct product of the failure to be concerned with morphological appraisal of the constituent architectural components that underpin city form. Caniggia and Maffei confirm this problem of coherence within urban tissues:

> …from interpretation we must learn not only to build but to check whether what we produce each time fits in with its context; therefore, from interpretation we must understand the co-presence and derivations system in which the building that we introduce into its context has to participate as efficiently as possible, within the limits of the tools that we shall have managed to use (Caniggia and Maffei, 2001, p. 68).

Appraisal of the townscape over time requires its constituent physical elements to be identified and analysed for evidence of rules of conformity. Infused with architectural characteristics, responses that stem from knowledge of the past can contribute towards achieving increased consonance within townscapes (Sanders, 2008, 2013). Kropf (2011) suggests that urban morphology provides the best tool to advance the practice of urban design and can reveal order within the apparent complexity of urban form. He does, however, caution against assuming that developing a process that only allows for continuity, and equates evolution with progress, will necessarily result in unity (Kropf, 2001). The importance of avoiding an overly prescriptive approach in the application of design tools is becoming increasingly apparent. Research should provide a source for interpretation in the formation of a design, rather than be a controlling device (Sanders, 2013).

Understanding the composition of the townscape

The townscape can be understood by evaluating the characteristics of its initial design (Johns, 1965) and its evolution into its modern form (Larkham and Jones, 1991; Smailes, 1955). The term 'townscape' stems from an approach to composition that was introduced by Sharp in the 1930s. In this approach the street is considered to be the key urban structure. It is a large-scale composition defining the visual appearance of a place. Sharp connected empirical analysis to prescriptions for future forms by combining old with new (Pendlebury, 2009). Townscape was subsequently championed in the editorial sections of the *Architectural Review* (Erten, 2009). These regularly featured Cullen's concept of 'serial vision', illustrated through the use of streetscape sketches (Larkham, 2006) in which the fabric of towns was examined in terms of attributes, including colour, texture, scale, style and character (Cullen, 1961).

Conzen (2004a) developed two important aspects of 'townscape morphology': first, the formative processes of the townscape in the past and present, including social, economic and cultural impulses; and secondly, the persistence of forms within the townscape. He described the townscape and its historicity as being expressed in the town plan, building form and land utilization. The building fabric and architectural styles were important components of building form, one aspect of which was their aesthetic value, including the stimulus of dominant features (Whitehand, 1987). Also important for Conzen were the three-dimensional components of building materials (external walls, roofs), building types and floor-space concentration (Conzen, 2004a): these are of especial significance in respect of the town silhouette (Conzen, 2004d). At the small scale of single or individual plots or small groups of plots, the 'townscape cell' or 'morphotope' is important (Conzen, 2004b, p. 260).

The longevity of architectural types within historical urban areas is also common to the typomorphological investigations of Caniggia (Marzot, 2002) and Sabelberg (1983). Caniggia identified 'building' as the fourth morphological scale, following in descending order the sequence of: 'territory', 'town/city', and 'aggregate tissue' (Maffei, 2009). In this system, the interpretation of 'building' is where the organic unity allows building forms to coexist and succeed one another in a balanced system of scalar components, such as bricks, beams, walls, roofs and fences (Caniggia and Maffei, 2001).

> In linguistics, morphology *excludes* meaning … By implication, if linguistics offers a useful parallel, urban morphology should not be concerned with meaning but with the formal characteristics of the elements of urban form. It should establish what the elements are and to which categories they belong, as well as to identify the patterns of relationships between the elements, considered both as individual entities and instances of general kinds (Kropf and Malfroy, 2013, p. 129-30).

The smallest scale units of a building's architectural language, determined by the prevailing construction techniques and availability of building materials, are combined to produce a specific vernacular style. Its elements can be distilled into the elementary components of the building, and consequently street façade system, that are measureable and can be tabulated into a syntax for evaluation and/or application. In essence these observations convey terms of reference for analysis of architectural aspects of the townscape.

The challenge to develop a visual analytical tool to interpret the language of a given streetscape in terms of its 'strict linguistic continuity' (Maffei, 2009, p. 8) was therefore the motivation for the research that is the basis of this paper. It is framed in two questions. First, how can traditional approaches to urban morphology be adapted in order to evidence change in architectural configuration within an urban fabric? Secondly, how can architectural elements within urban forms be identified, and criteria for measurement be established?

Evaluating architectural elements within the townscape: a Brisbane case study

Consideration of an appropriate scale is paramount in deciding the scope of urban morphological research (Caniggia and Maffei, 2001). When dealing with a large expanse of the city, maintaining the necessary level of detail at which change needs to be assessed is demanding. Yet limiting attention to particular buildings compromises appreciation of the city as a whole (Holdsworth, 1992).

This problem has been to some extent overcome in the research presented in this paper by the engagement of undergraduate students to conduct a survey of the entire central area of Brisbane, Australia. This involved the compilation of a comprehensive record of data recovered from multiple municipal and private archives. Under the direction of the authors, pairs of students were each allocated two street blocks within the central city grid as the focus for their search for relevant data. This enabled relevant documents for the entire city centre to be collected.

M. R. G. Conzen's town-plan analysis approach (1960), later developed by Koter (1990) and M. P. Conzen (1990), demonstrates how urban morphogenetic study requires a temporal frame of reference in the form of a sequence of morphological periods (Conzen, 2004c; Whitehand, 2001). In the present study the dates of key surveys and major civic events in Brisbane determined the temporal cross

Table 1. Temporal cross-section, showing dates of key surveys and civic events

Date	Significance of event/production of archival material
1842	Brisbane Town - early settlement. Wade's Plan of the Town of Brisbane & Map of the Environs of Brisbane Town - following Dixon's Plan of Brisbane River and Moreton Bay 1839 (see Figures 1 and 2)
1863	Ham's Map of the City of Brisbane, Queensland
1893-95	Plan of the City of Brisbane and Suburbs - indicating flooded areas & Mckellar's Official Map of Brisbane and Suburbs. City of Brisbane, Street Alignment Plans 1899-1906.
1911-24	Metropolitan Water and Sewage Board Detail Plans (see Figure 4), and various pictorial images coinciding with the commencement of First World War.
1930-55	Period of economic recession/depression leading up to, and including Second World War. Documents include Fire Survey Plans (see Figure 4).
1960	Beginning of period of economic renewal.
1974	Major flood event. 1978 Cadastral Plan.
2005	Date of research data collection and preliminary mapping.
2012	Date of research data verification and revised mapping.

sections (Table 1).

The sources of data employed were survey maps, period photographs, and written accounts of places and events in newspapers and other documentary sources (Sanders and Schroder, 2008). Data were verified through the triangulation of relevant archival sources. The maps prepared by the students were cross-referenced with the archival material. Several inaccuracies were revealed which required amendments to the research drawings. Inaccuracies were also identified in some of the archival material. This subsequently prompted the State Library of Queensland to amend its records (Sanders and Woodward, 2014). The maps presented in the following sections of this paper, and the measurements drawn from them, incorporate the results of these necessary checks and amendments.

Brisbane: settlement configuration

A coherent body of morphological research has yet to emerge in Australia, despite fairly extensive published accounts of the country's planning and settlement history. The comparative analysis of street block sizes of several Australian and American cities by Siksna (1997) is an important work which revealed that the relationship of both block size and form have predictable effects on subsequent evolutionary patterns.

The original settlement of Brisbane was initially assessed by three surveyors (Dixon, Warner and Stapylton) who had been sent by the colonial government to Moreton Bay in 1839 with a view to recommending sites for towns, villages and other purposes (Johnson, 1988). The following year, Dixon drew up a plan proposing the layout for the new town, incorporating a system of large square grids, each ten chains (about 201 m) in length, and streets one chain wide (Johnson and Gregory, 1989). The original prisoners' barracks building provided a point of reference for the main alignment. Dixon's plan was subsequently modified by Wade who amended the square blocks into rectangular grids. There was considerable debate regarding the suitable width of streets, partly owing to Governor Gipp's view that Brisbane would not develop into a very significant town (Johnson, 1988).

Mapping: spatial system and building fabric

Several types of mapping were employed

Figure 1. Part of a plan of Brisbane Town in 1840, by Robert Dixon. The white overlay frame indicates the study area. Source: National Library of Australia MAP G9004.B7, 1840.

including cadastral plans, figure-ground representations, building plans, street elevations and cross-sections through street blocks. These, together with a taxonomy of building types, were consolidated into two linked categories: first, the spatial system (cadastral plans and block plans); and secondly, the physical fabric (building envelope, architectural features, surface area, structure, height and setback).

The relationship between these two aspects is presented by means of a detailed sample study (see highlighted area in Figures 1 and 2). First, the spatial system transformation is presented as evidenced by changes to the cadastral and block-plan configuration; and secondly, the significance of the elevational studies has prompted a suggested new method to link measurements of architectural elements with a syntax of parameters for new designs.

Cadastral configuration and block plans

The development of the form of urban areas is heavily contingent upon the town plan. This frames the land utilization pattern and building fabric. The street pattern is the most persistent and stable element; and the land utilization is the least resistant to change (Birkhamshaw and Whitehand, 2012; Conzen, 1960).

A significant concept developed by Conzen (1960) was the ‘burgage cycle’, being the sequence of gradual building additions over time within the rear spaces of plots. This process is followed by the clearance of structures and the initiation of a redevelopment cycle. Plots are subject to increasing pressure, often associated with changed functional requirements, in a growing urban area (Gauthiez, 2004; Whitehand, 2007). This process was recognized by Koter (1990) in his study of an industrial-era plot pattern in Łódź,

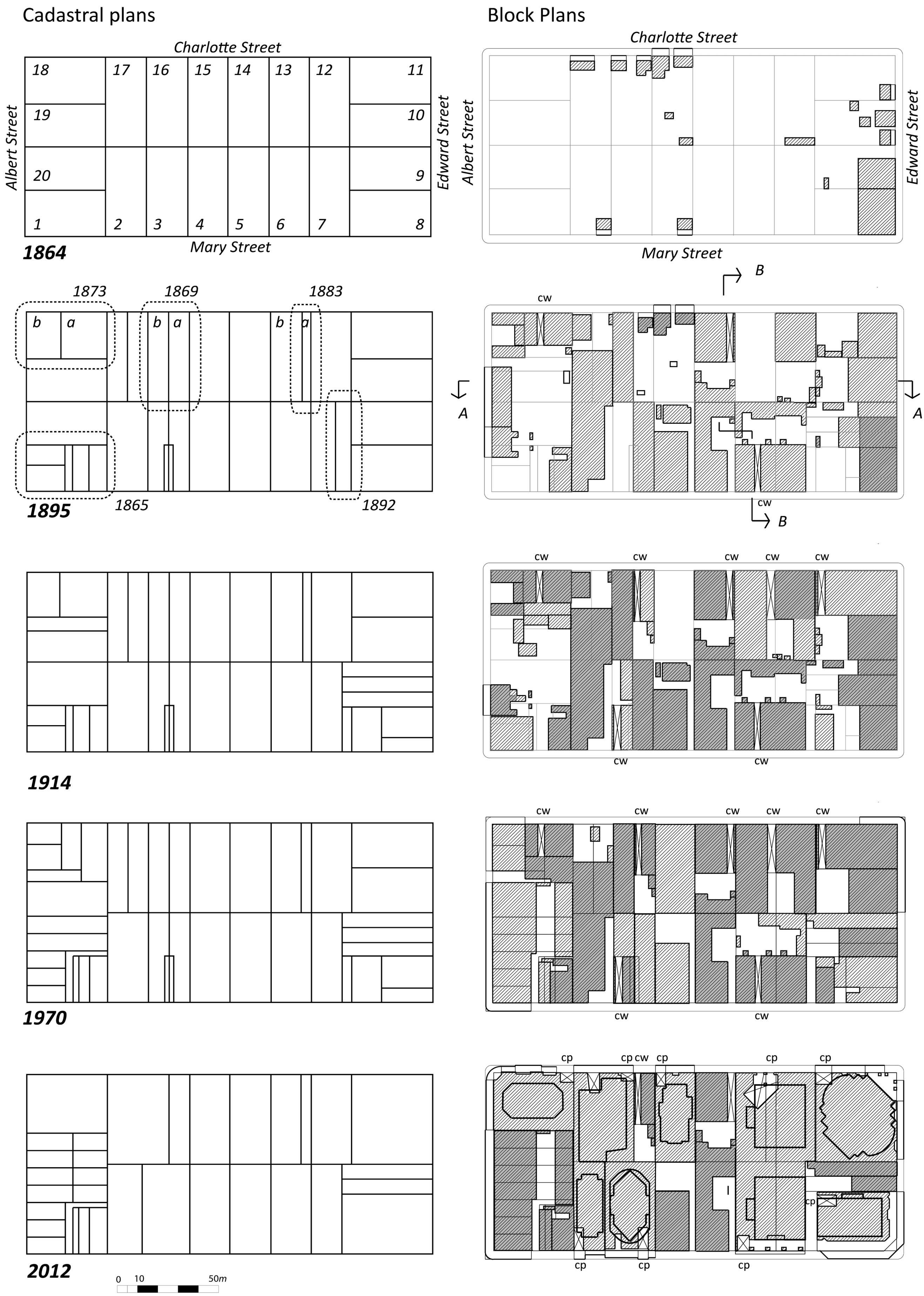
Figure 2. Part of a plan of Brisbane Town in 1842 by H. W. Mariott. The white overlay frame indicates the study area. Source: Queensland State Archives Item ID 2774.

Poland.

Muratori's concept of planning typology defines spontaneous and planned phases of urban growth (Cataldi *et al*., 2002 p. 10) within the laws of continuity of transformational processes (Marzot, 2002 p. 62). In this approach basic building is the primary component of the operational history, with its figurative, functional, material and typological properties understood within the plot identification and typological survey of the urban form (Maffei, 2009).

Understanding the relationship between plot and building evolution within the town plan is therefore fundamental to urban morphological study (Conzen, 1990). The cadastral plan provides the dimensions of the street block within which the processes of subdivision and/or consolidation, and the corresponding change in building fabric, can be identified. In Brisbane, the original settlement pattern was based on 200 x 90 m rectangular street blocks, with a street spacing mesh of 221 x 111 m; each street block was divided into twenty equal back-to-back plots (Siksna, 1997).

Figure 3 shows a typical street block bounded by Charlotte, Mary, Albert and Edward Streets, and the changes to the layout over time. The corresponding transformation of the built form, represented by the block plan, has been developed by the authors, using established methods of town-plan analysis such as those employed by Conzen (1990) in North America. It is evident that this city block underwent subdivision from the outset as land owners were attracted by the profit that this provided (Sanders and Schroder, 2008). The earliest subdivision is recorded as being in 1865 on the allotment at the corner of Albert and Mary Streets (Department of Natural



Key: cw = cartway cp = carpark Dark shaded area = building that persists from previous temporal plan
Arrows = section lines cf. Figure 8

Figure 3. Plot boundaries and block plans of a Brisbane city block bounded by Charlotte, Edward, Mary and Albert Streets, 1864-2012.

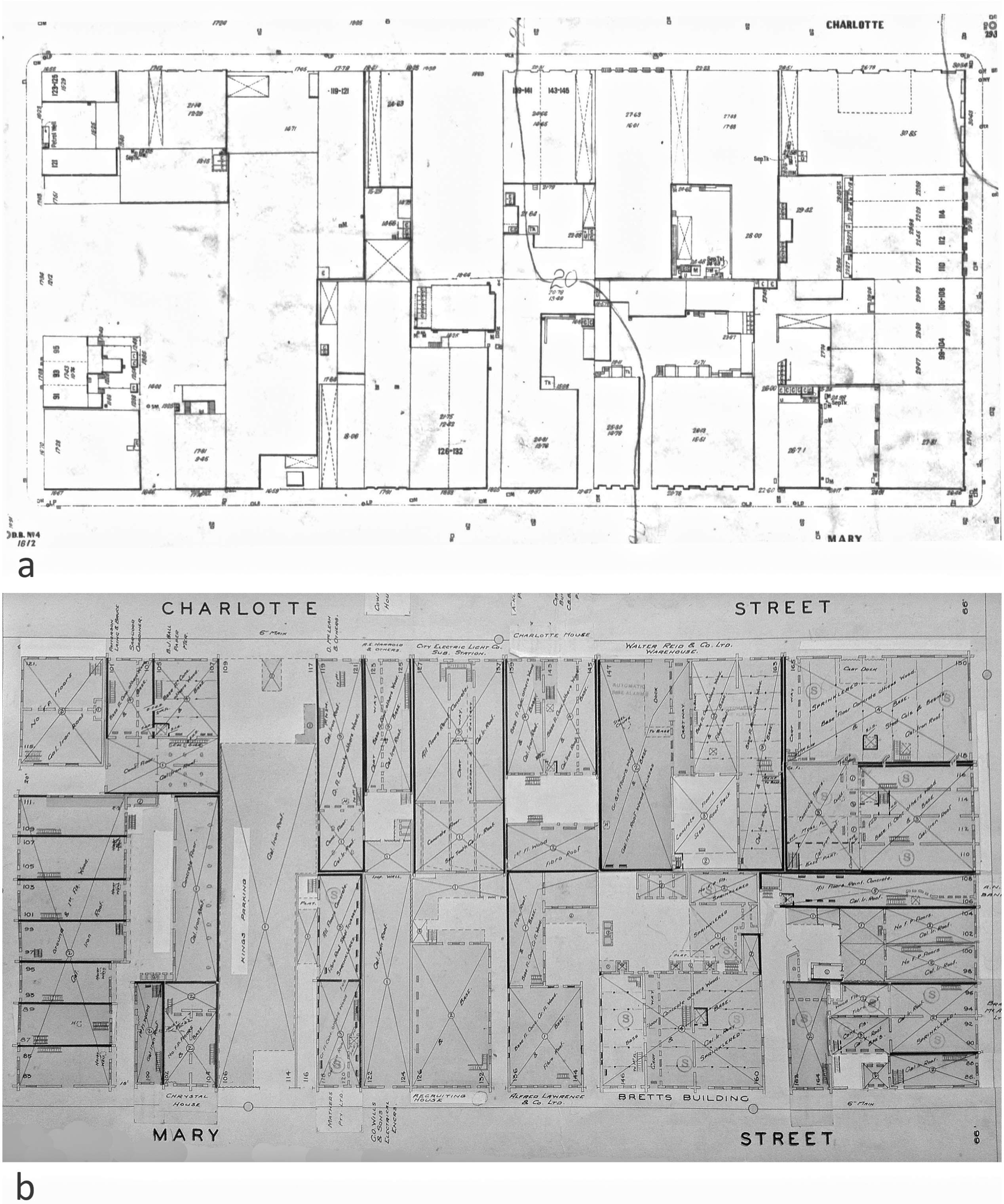


Figure 4. Municipal services survey documents. a) Mathews, E. J. (1913) Metropolitan Water and Sewage Board, City of Brisbane. Detail Plan No 3. Source: Brisbane City Archives. b) Mahlstedt & Son (1951) *Brisbane Fire Survey 1951*. Source: Brisbane City Archives.

Figure 5. Central Brisbane in 1942. The white overlay frame indicates the study area. Source: John Oxley Library, State Library of Queensland, Brisbane.

Resources and Mines, 2014). This was followed by the subdivision of several plots before the belated introduction of *The Undue Subdivision of Land Prevention Act* in 1885. Thereafter the overcrowding of plots was subsequently avoided (Laverty, 1971).

Figure 4, municipal services in 1913 and 1951, and an aerial photograph of 1941 (Geoscience Australia, 2014) (Figure 5) have been used in combination with later surveys to provide evidence of changes in the urban configuration.

Simple timber and corrugated-iron houses were erected by the first free settlers following the first sale of land in Brisbane by auction in 1842 (Johnson and Gregory, 1989). The city had developed into an important regional trading town by the late-nineteenth century, with distinct administrative and commercial precincts. The principal building types that emerged as trade and commerce developed in close proximity to the wharves were workshops, warehouses and corner hotels. Warehouses were the predominant building type within the case study area, with heights of two to five storeys. They had elegant classical frontages, conveying the prosperity of their owners and occupants. The large street blocks presented problems of access which were overcome by the provision of cartways through the ground floors of many of the buildings, allowing for early service vehicles to access the rear of the plots (Sanders and Schroder, 2008).

Over the course of Brisbane's 170-year history there have been two significant economic periods, and these have generated two distinct periods of urban development. These were from the 1840s to 1914, and then, after 50 years of little development, a period of rapid growth between the 1960s and the present day. During the late-twentieth century, plots were amalgamated as the need for taller buildings with larger footprints increased.

Building form

A range of archival sources, including photographs, and drawings and paintings, has provided information about the three-dimensional properties of buildings no longer extant. Particularly useful was pictorial imagery from *Picture Queensland*, an open access online repository curated by the State Library of Queensland (State Library of Queensland, 2014).

Figure 6 provides examples of key information that has been critical in establishing changes to buildings in the study area. Photographic evidence of Brisbane dates from a panoramic view of 1862 (Figure 6a). Examined in conjunction with a street view of a flooded Charlotte Street the following year (Figure 6b), the scarcity of buildings at this time is evident.

Figure 6c, a view of Charlotte Street from its intersection with Edward Street, confirms the existence of warehouse buildings here at the time of the flood of 1893. The Butler Brothers Building (*c*. 1888) is in the distance, and in the middle ground is Charlotte House (*c*. 1888/9). In the foreground is Brabant House (*c*. 1883): this building, with its elegant classical revival façade, would be later extended in the same style on to the adjoining plot and renamed the Walter Reid Building. An additional third storey was added at the same time (Figure 6d/e). The Engineering Supply Company Building (*c*. 1914), prominent at the corner of Charlotte and Edward Streets, was designed by the renowned architects Hall and Dods (Figure 6e). It was one of the first buildings to break from a purely classical tradition towards a modern expression, with expressive structure, including glazing and copper panels, that had its roots in contemporary American architecture (Lund, 1969).

These photographs illustrate the level of architectural detail that can be scrutinized for translation into measured drawings for each building, and amalgamation into a composite streetscape. The street elevations comprise an evolving tapestry of openings (doors and windows), structural elements (columns and walls), verandas and awnings, stairs, arcades and passageways. The permanence of certain buildings is readily confirmed by reference to the block plans and elevations. The comprehensive documentation of how buildings are located within a morphological sequence is a valuable contribution to current heritage management.

Podium structures, as distinct from the detached independence of their tower forms, provide a direct relationship to the streetscape, as illustrated for 2012 in Figure 7. The control of the tower block type has been managed through planning control measures prescribed in various plans for Brisbane, the first of which was introduced in 1965 (Moran, 2006). For each plot, the building envelope of a proposed development has been subject to regulations that determined its building type, total floor space area, siting, height and coverage (De Gruchy, 1988). Articulated diagrams and complex formulae have controlled the dimensions for building setback requirements, maximum podium heights and pedestrian shelter that influenced in particular the form of the tower block types (Heywood, 1986, p. 31).

Street-block cross-sections

In conjunction with the block-plans, the sections reveal changes in building scale and land utilization (Barbeler and Guaralda, 2011). They confirm building depth, and the relationship of building frontage to the street. Figure 8 shows for 1895 how an inner-block open space system was established, with cartway openings in the building providing entrances for service vehicles.

Measurement, tabulation and analysis

> Interpreting building structures means understanding and making use of the logical tools and structures of the built environment

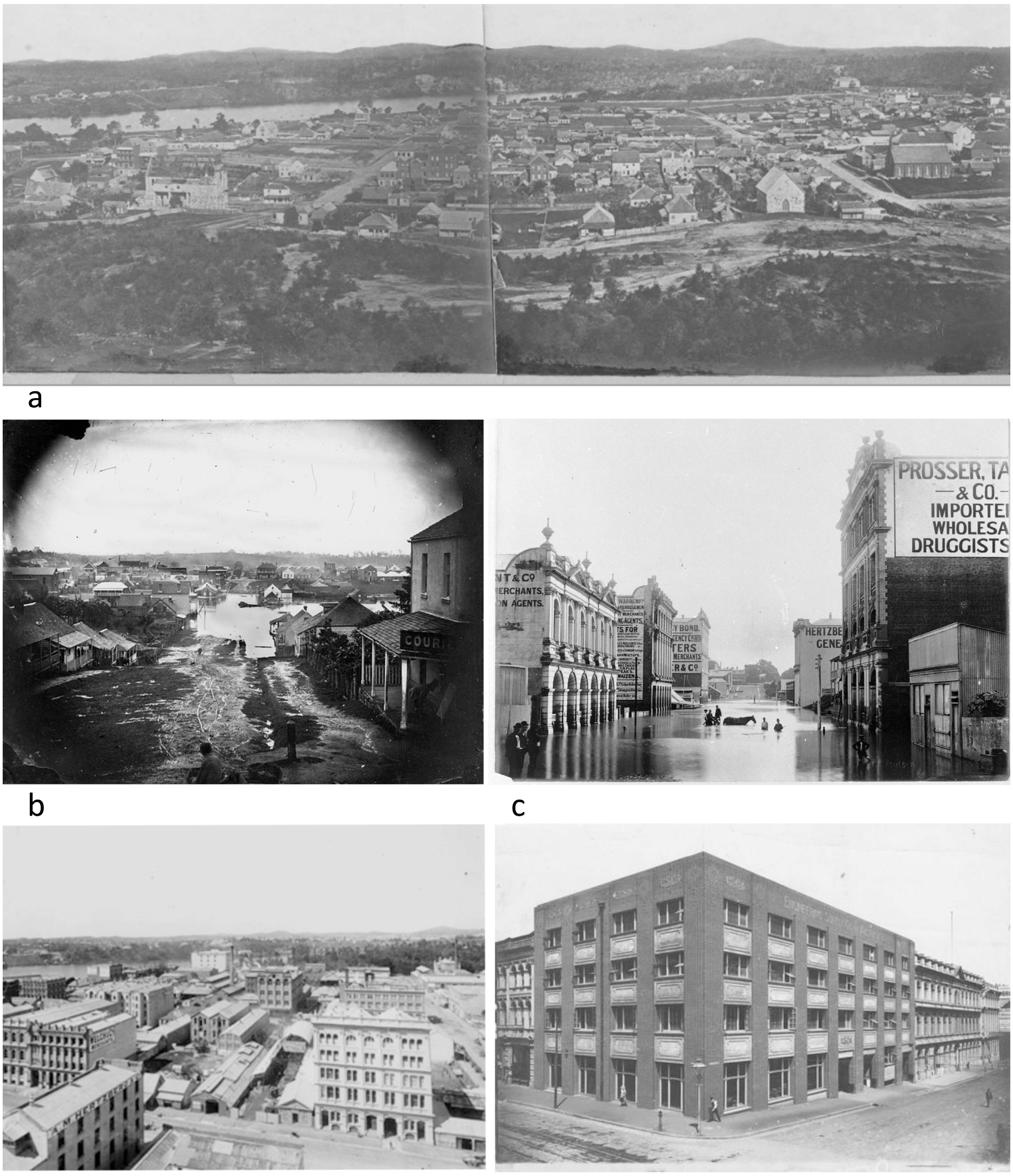


Figure 6. Examples of photographic evidence retrieved from archival collections. a) Panorama of Brisbane in 1862. Source: John Oxley Library, State Library of Queensland, Brisbane. b) Charlotte Street, Brisbane, during the flood of 1864. Source: John Oxley Library, State Library of Queensland, Brisbane. c) Flooded Brisbane streets in 1893 by P. C. Poulsen. Source: The Australian National Maritime Museum, Sydney. d) View from the Perry Bros. building at the corner of Elizabeth and Albert Street, *c.* 1913. Source: John Oxley Library, State Library of Queensland, Brisbane. e) Building belonging to the Engineering Supply Co. of Australia. Source: John Oxley Library, State Library of Queensland, Brisbane.

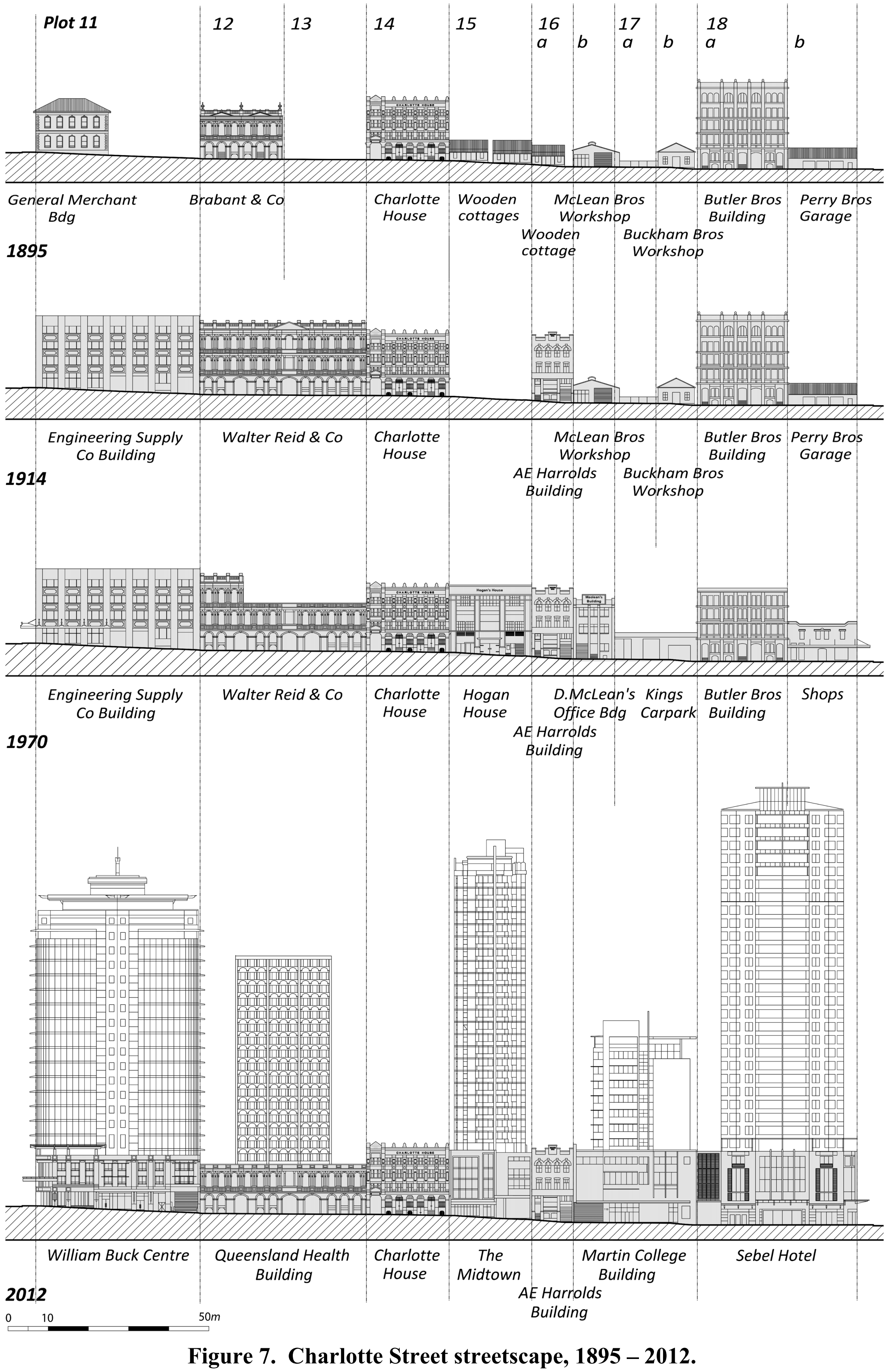


Figure 7. Charlotte Street streetscape, 1895 – 2012.

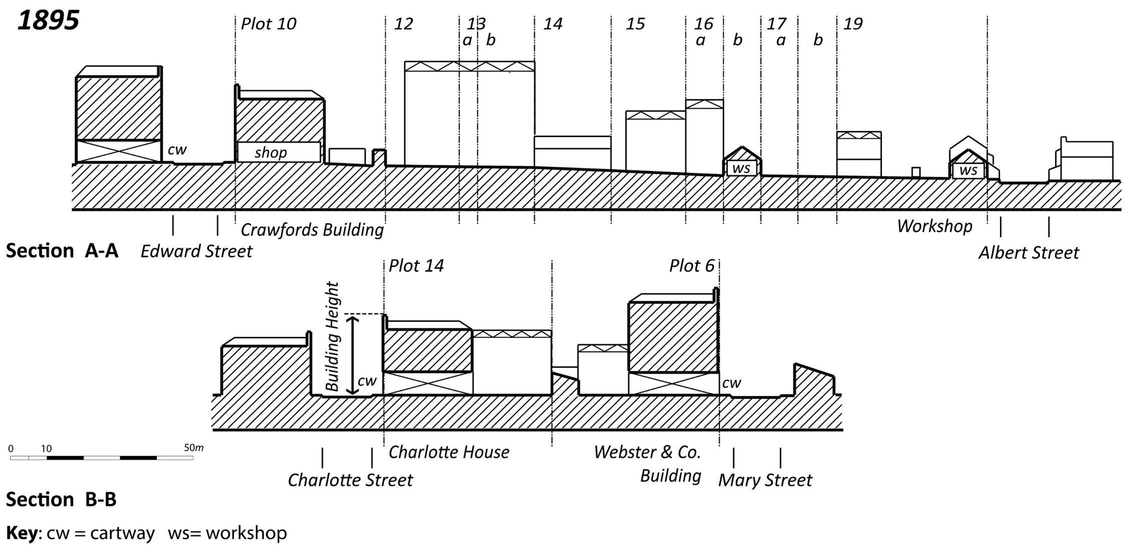


Figure 8. Street-to-street cross-sections, 1895 (cf. Figure 3).

> characterizing a cityscape; in other words, understanding the components of a man-made complex. Elements on a minor scale... walls, rooms, floors, fences ...etc. (Caniggia and Maffei, 2001, p. 62).

Measuring building form

The distribution of architectural elements across the street façades establishes frequencies and rhythms that are related to the original regular plot pattern. The degree to which these associations continue over time varies. New building forms reflect the plot subdivisions and amalgamations. Disruptions of original frequencies and rhythms occur, resulting in changes to physical volume and architectural language.

The building envelope and its footprint, façade height and setbacks in street elevation combine with these aspects of other buildings within the block structure to establish the volumetric massing characteristic of the urban fabric. A distinction can be made between the façade (height, surface area and linear frontage) and the block plan (plot area, building coverage and open space).

Measuring shapes

Caniggia and Maffei (2001) refer to the system organism that combines together in the assemblage of a building. It is comprised of elements (small components – for example, bricks and beams); elementary structures (associations of elements – for example, floors, walls, partitions and roofs), and structural systems (for example, rooms and stairs). Similarly, in the process of formulating measurements for a building's detail, the authors have classified components into three aspects. These are windows and doors (number, surface area, profile, shape); features (cartways, loading docks, car park entrances, canopies, entry stairs); and materials (walls, roofs).

The characteristics of the façades of each component recorded according to its outline shape and frequency combine to achieve a comprehensive integrated appraisal. Whether read singularly or as an amalgam, or by metric value or shape profile, the characteristics of each individual building are defined by the record of each element. Figure 9, using Charlotte House as a detailed example, illustrates how the architectural detail in the façade, which includes building height, surface area of

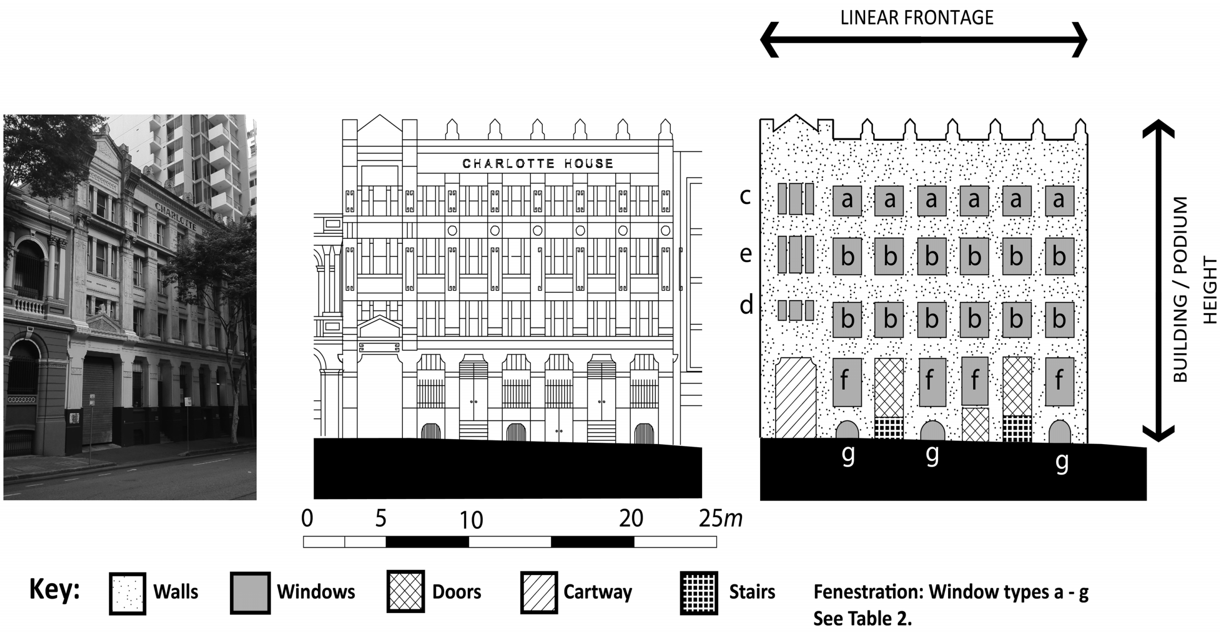


Figure 9. Charlotte House between 1886 and the present. Identification and measurement of architectural elements (see also Table 2).

walls, doors and window shape, has been identified.

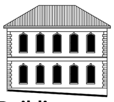
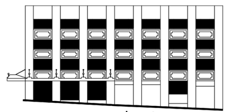
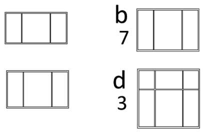
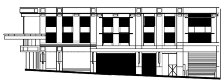
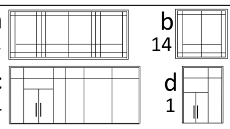
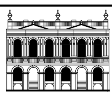
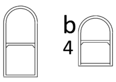
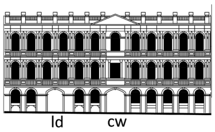
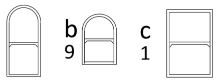
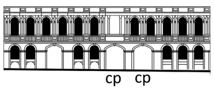
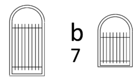
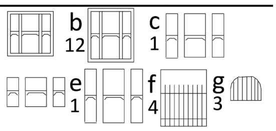
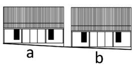
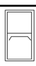
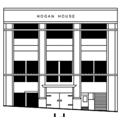
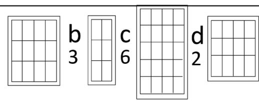
Tabulation of measurements

Tables 2 and 3 have been presented in such a way that the façade for each building has been tabulated, including all the measurements associated with it. The shape characteristics of relief elements have been itemized, allowing visual assessment of the fenestration items, and appraisal of variations in the cumulative streetscape language. Measurements for the tower forms in 2012 have not been included in these tables, as they are not directly associated with the streetscape: only the podium sections of these buildings are included.

The dialectical relationships of the entire streetscape have been generated as a basis for quantitative analysis by calculating the arithmetic mean of each building's measurements, associations and systems. The measurements for all the structures have been summarized in Table 4, in accordance with their position in relation to both time and location (plot number). Façade, fenestration, architectural features, materials and block plans can be examined by date, and values of streetscape form accumulated for the entire study period. Various summaries can be extracted according to the guiding principles of a particular inquiry. For example, it may be important to establish average building heights at any given period within the streetscape, or alternatively average building heights across the entire diachronic survey.

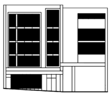
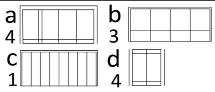
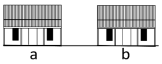
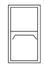
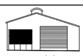
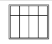
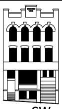
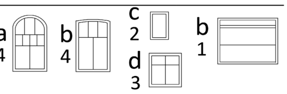
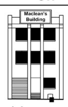
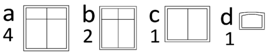
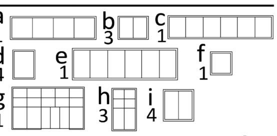
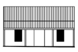
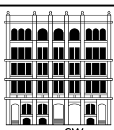
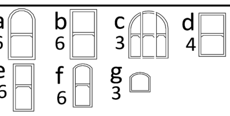
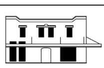
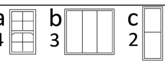
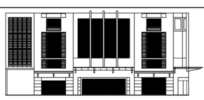
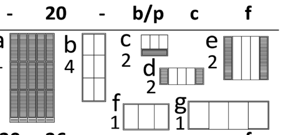
There was an associated increase in façade height and surface area in the course of the nineteenth century. In the early settlement, simple single-storey structures were widespread. The newer buildings have retained similar podium heights to earlier buildings within the streetscape. In contrast to the general similarities in the façade volumes of building and podium structures, the coverage and shape of fenestration elements has increased over time. Whereas smaller timber window and door elements are evident in most pre-1970 buildings, advanced construction technologies have enabled much larger curtain wall structures in recent buildings.

Table 2. Tabulation of architectural elements, Plots 11-15 Charlotte Street.

Building description, Element shape & measurement.	Block Plan			Façade				Fenestration									Features			
								Windows			Doors							Materials		
	Plot Area m²	Building Coverage %	Open space m²	Podium height m	Storeys (above grd)	Surface Area m²	Linear Frontage m	Overall Number	Surface Area m²	Surface Area %	Overall Number	Surface Area m²	Surface Area %	Loading dock m²	Cartway / Car Park m²	Canopy coverage m	Entry stairs width m	Walls	Roof	Pitched / flat
Plot 11	Description							Shape												
	**Type**: Warehouse/ offices **Style**: Neo-classical (plain) **Features**: Plaster quoining							a) Vertical sash window with arched head							 a 10					
1895 General Merchant Building	1781	50	447	11.3	2	199.6	17.6	10	34.5	17	0	-	-	-	-	-	-	b	ci	p
 d d cw	**Type**: Warehouse/ offices **Style**: Modern **Features**: Expressive structure copper infil panels							a) Horizontal metal - pivot b) Horizontal metal - pivot c) Horizontal metal - pivot d) Metal shopfronts							 a 14, b 7, c 1, d 3					
1914 > 1970 Engineering Supply Co.	1781	100	0	20	4	800.6	40	25	120	15	2	32	4	32	16.6	21.7	-	b	c	f
 cp	**Type**: Office/ retail **Style**: Modern/ commercial							a,b) Aluminium windows c,d) Aluminium & glass shopfronts							 a 2, b 14, c 1, d 1					
2012 William Buck Centre podium	1781	100	0	13.3	4	532.9	40	16	78.2	15	7	76.7	14	-	25	35.8	9.8	c	c	f
Plot 12	Description							Shape												
	**Type**: Warehouse/ offices **Style**: Classical revival (ornamental) **Features**: As below							a,b) Vertical timber sash windows with rounded head							 a 6, b 4					
1895 Brabant & Co.	909.5	43	515	14.6	2	275.4	20.1	10	44.1	16	2	21.1	8	-	-	-	-	3.2	p	ci
Plot 12/13	Description							Shape												
 ld cw	**Type**: Warehouse/ offices **Style**: Classical revival (ornamental) **Features**: Rusticated plinth Corinthian columns Entablature and pediment - Stone finials							a,b) Vertical timber sash windows with rounded head. c) Vertical rectangular timber sash window							 a 23, b 9, c 1					
1914 Walter Reid & Co.	1804	85	271	19.9	3	792	40.4	33	153	19	1	12.9	2	18	20.2	-	-	p	ci	p
1970 > (post fire)	1804	85	271	13.9	2/3	561.6	40.4	22	102	18	2	33	6	18	20.2	-	-	p	ci	p
 cp cp	**Type**: Warehouse/ offices **Style**: Classical revival (ornamental) **Features**: Heavy rusticated plinth Corinthian columns							a,b) Vertical aluminium window with rounded head- Metal grating							 a 11, b 7					
2012 Queensland Health Building podium	1804	100	0	11.9	2	480.3	40.4	18	88	18	2	33	6	-	43			p	c	f
Plot 14	Description							Shape												
 cw	**Type**: Warehouse/ offices **Style**: Classical revival (Egyptian) Doric pilasters / Stone finials Decorative plasted panels							a,b,c,e) Vertical timber sash windows d)Horizontal timber sash window f,g)Timber Windows with metal gratings							 a 6, b 12, c 1, d 1, e 1, f 4, g 3					
1895 - 2012 Charlotte House	896.2	54	411	17.7	4	333	20.1	28	88.4	27	2	14.1	4	-	12.6	-	3.4	p	ci	p
Plot 15	Description							Shape												
 a b	**Type**: Gable roofed cottage							a) Vertical timber sash windows							 a 4					
1864 - 1895				a-6.1	1	26	9.3	2	3.2	12	1	2.2	8	-	-	9.3	-	w	ci	p
Workers Cottages x 2	897.6	15	763	b-6.1	1	26	9.3	2	3.2	12	1	2.2	8	-	-	9.3	-	w	ci	p
 ld	**Type**: Warehouse/ offices **Style**: Modern (plain)							a,c) Vertical metal pivot windows b,d) Square metal pivot windows							 a 6, b 3, c 6, d 2					
1970 Hogan House	897.6	100	0	17.8	3	358.4	20.1	17	50	14	5	33.5	9	20	-	-	-	b/p	c	f

Key: cp = car park cw = cartway ld= loading dock **Materials** w = wood b = brick ci = corrugated iron p = plaster c = concrete mp = metal panel
Roof p = pitched f = flat

Table 3. Tabulation of architectural elements, Plots 15-18 Charlotte Street.

Building description, Element shape & measurement.	Block Plan: Plot Area m²	Block Plan: Building Coverage %	Block Plan: Open space m²	Façade: Podium height m	Façade: Storeys (above grd)	Façade: Surface Area m²	Façade: Linear Frontage m	Fenestration – Windows: Overall Number	Windows: Surface Area m²	Windows: Surface Area %	Fenestration – Doors: Overall Number	Doors: Surface Area m²	Doors: Surface Area %	Loading dock m²	Features: Cartway / Car Park m²	Canopy coverage m	Entry stairs width m	Materials: Walls	Materials: Roof	Pitched / flat
Plot 15 (continued)	Description							Shape												
	**Type**: Commercial offices **Style**: Modern **Features:** Aluminium cladding Curtain wall glazing							a,d) Curtain wall window panels b) Glass sliding door panels c) Bi-folding glass doors												
2012 **The Midtown** podium cp	897.6	100	0	15.9	4	320.4	20.1	8	92.8	29	5	76.7	11	-	17	20.1	-	mp	c	f
Plot 16	Description							Shape												
 a b	**Type**: Gable roofed cottages							a) Vertical timber sash												
				a-4.6	1	20.8	8	2	3.2	12	2	21.1	8	-						
1864-1895 Workers Cottages	897	82	815	b-4.6	1	20.8	8	2	3.2	12	2	21.1	8	-	-	-	-	w	ci	p
1895-1914 **McLean Bros Workshop**  ld	**Type**: Workshop							a) Timber fixed panel												
	435	100	0	5.2	1	51.4	11.3	1	7.4	14	2	19.2	37	-	-	-	-	w	ci	p
 cw	**Type**: Warehouse/ offices **Style**: Neo-classical (plain) **Features**: Facebrick finials							a, b)Vertical timber casement c, d) Timber fixed e)Horizontal timber fixed												
1914-2012 **AE Harolds Bldg**	461	57	196	17.9	3	180.5	10.1	14	39	22	2	15.6	9	-	12.4	-	1.4	b	ci	p
 ld	**Type**: Offices **Style**: Modern (plain)							a,b)Vertical timber casement c,d)Horizontal timber casement												
1970 **D. McLeans Office Bldg**	435	100	0	16.1	3	161.5	10	8	25.8	16	1	6.6	4	-	-	-	1.2	b/p	c	f
Plot 16/17	Description							Shape												
 cp	**Type**: Education **Style**: Modern (plain) **Features:** Aluminium cladding							a,b,c,e,f,i) Horizontal aluminium windows d)Aluminium window fixed g-h) Aluminium shopfronts												
2012 **Martin College Building** podium	1336	100	0	18.2	3	547.3	30.1	12	135.9	25	2	38.4	7	-	30	27.6	-	mp	c	f
Plot 17	Description							Shape												
1864 **Workers Cottage** 	**Type**: Gable roofed cottage							a) Vertical timber sash												
	447	13	391	5.6	1	33	11.8	2	4.7	14	2	5.4	16	-	-	6.9	-	w	ci	p
1895-1914 **Buckham Bros Workshop** 	**Type**: Workshop							a) Vertical timber casement												
	895	13	780	6.1	1	53.8	8.8	2	4.7	9	1	5.4	10	-	-	-	-	w	ci	p
1970 **Kings Carpark**  cp	**Type**: Car Park / Shed																			
	895	57	384	7.1	1	143.3	20.1	-	-	-	1	21	15	-	-	15	-	b	ci	p
Plot 18	Description							Shape												
 cw	**Type**: Warehouse/ offices **Style**: Neo-classical (plain) **Features**: Ionic pilasters & Stone finials							a,c,f) Vertical timber sash window rounded head b, d, e) Vertical timber sash-window g) Timber window fixed												
1895-1914 **Butlers Bros.Building**	487.9	100	0	24.5	5	525.5	21.9	54	145.8	28	3	17.5	3	-	11.5	-	5.1	p	ci	p
1970 renovated	487.9	100	0	18.9	4	412.2	21.9	45	113.8	28	3	17.5	3	-	11.5	-	5.1	p	ci	p
1895-1914 **Perry Bros Workshop**  ld	**Type**: Workshop																			
	378.5	62	144	5.9	1	46.7	16.7	-	-	-	4	23.9	3	-	-	-	-	w	ci	p
	**Type**: Shops							a)Vertical timber sash b & c) Timber shopfronts												
1970 **Shops**	378.5	100	0	11.2	2	189.3	16.9	7	22.5	12	1	6.6	3	-	-	20	-	b/p	c	f
 cp	**Type**: Hotel/ retail **Style**: Modern							a) Aluminium louvres b-e) Curtain wall glazing & aluminium louvres f -g)Aluminium & glass shopfront												
2012 **Sebel Hotel** podium	1154	100	0	18.1	4	702.7	38.8	17	250.4	36	4	59.9	9	-	30	36	-	c	c	f

Key: cp = car park cw = cartway ld= loading dock **Materials** w = wood b = brick ci = corrugated iron p = plaster c = concrete mp = metal panel
Roof p = pitched f = flat

Table 4. Collation of streetscape data (averages) Charlotte Street

		1864		1895		1914		1970		2012	Total average
Façade											
Height - Podium/ Façade	m	2.7		8.7		16.4		15.5		15.8	11.8
Storeys	no.	1		1.7		2.4		2.8		16.2	4.8
Podium/ Façade	no.	1		1.7		2.4		2.8		2.8	2.1
Storeys - *range number*	no.	1		1-5		1-5		1-4		1-3	1-5
Surface area	m^2	22.7		155.8		309.3		365.9		344.2	239.6
Fenestration											
Windows	no.	2		11		19.5		19.4		114.3	33.3
Podium/ Façade	no.	2		11		19.5		19.4		19.3	14.3
Surface area	m^2	3.5		36.3		81.4		78.1		117.8	63.4
Total Surface area	%	15		23		26		21		38	17.9
Doors	no.	1		2		2.3		2.2		3.3	2.1
Area	m^2	2.8		10.6		18.3		18.7		39.0	17.9
Total Surface area	%	13		7		6		5		6	7
Features											
Canopy	m	8.1		8.9		0		20.9		29.9	13.5
Cartway / Carpark	m^2	0	*2 no. >*	12.1	*5 no. >*	15	*7 no. >*	15.5	*8 no. >*	22.8	16.3
Entry Stairs	m	0		4.3		3.3		3.3		4.9	3.9
Block plan											
Building coverage	m^2	1805.7		2768.9		3309.5		6442.1		7721.7	4409.6
Open space	m^2	6250.0		4377.3		2700.9		1262.8		607.3	3039.7

Building features varied over time. For example, the verandahs that were originally fronting structures on the cottages of the settlers disappeared with the demolition of these early buildings. The warehouse types that were constructed in their place made no provision for pedestrian shelter and hence there were no canopies along Charlotte Street by 1914. Following the opening in 1929 of a new showroom in the remodelled and extended Engineering Supply Co. of Australia building, there was an increase in the number of retail, commercial and residential buildings and a consequent increase in pavement canopies.

Initially the means of vehicular access to the interiors of street blocks was cartways through warehouse buildings. The increase in the occurrence of car park entrances into recent tower and podium building types has resulted in a major increase in the surface area of façades occupied by such entrances. Building coverage has also increased dramatically over the study period, owing to the construction of commercial buildings over entire plots. The only remaining open space in 2012 was where buildings were built before 1970.

Analysis: syntax for a new design approach

> The urban landscape as a vast reservoir of experiences passed down by previous societies became recognised as an educative source and therefore not lightly expendable but something to be assessed, learned from, sometimes conserved and, not least, used to inform the creation of new urban landscapes (Whitehand, 2005).

Understanding how the current streetscape relates to its predecessors is fundamental to establishing the parameters for new buildings. The changes articulated in the tabulated syntax, combined with visual representations of its architectural language, provide the basis for analysis. Data compiled for each site can be combined with the data collected from neighbouring streetscapes to aggregate into data sets at different scales of complexity and specificity.

Conclusion

This paper demonstrates the basis of a method for assessing architectural elements within an existing urban form. The historical analysis that provides the foundation for design guidelines is also a contribution to the scholarship of architectural aspects of urban morphology. A taxonomy of architectural elements within the evolutionary process of a sample urban fabric has been established. From this a tabulated syntax of measured values has been deduced from morphological mapping. This method provides a powerful tool in the process of managing city form. Through the evaluation of building fabric, parameters for the application of new building forms have been derived. This approach deals with quantitative attributes that are readily presented as a data set for interpretation. When transferred into a design code, there is the basis for maintaining consonance of building character within new and adapted streetscapes. Rooted in tradition, yet self-consciously modern, this way of thinking about planning and design that was first established by Sharp (Pendlebury, 2009, p. 22) removes nostalgic or emotive values from the discussion of what may constitute good urban form.

A preliminary report of recommendations by the ISUF Task Force on Research and Practice in Urban Morphology has called for the 'creation of an urban morphology toolkit for understanding the past, and planning the future of urban settlements' (Samuels, 2013). It is hoped that the schema presented in this paper is an example of such a toolkit. It appraises the characteristics and qualities of a particular place in an objective evidence-based approach that architects and urban designers have largely lacked in the reasoning of their propositions (Sanders, 2013).

The general importance and wider significance of this work lies in the proposed method. It overcomes the limitations of current architectural approaches to urban analysis, whilst underlining the evolving advocacy of how urban morphology can be an integral discipline in the design of our cities.

Further work is recommended through practical examples of how architects, guided by a morphological syntax, can design a building within a research area in such a way that the levels of congruence of the resulting design can be assessed and analysed. We suggest that designs that follow the principles of this approach will demonstrate greater levels of congruence for new urban forms.

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First PNUM workshop on urban morphology: Different approaches in the study of urban form

The First PNUM workshop on urban morphology, 'Different approaches in the study of urban form' will take place in the Faculty of Engineering of the University of Porto, Portugal, from 30 June to 4 July 2015.

This week-long workshop is particularly relevant to students, academics, researchers and professionals in the fields of architecture, geography, planning and history. The main goal of the workshop is to offer insight into a set of theories, concepts and methods for the analysis of the physical form of cities.

During the first day of the workshop, different morphological approaches (historico- geographical, process typological, space syntax and spatial analysis) and the case study, the city of Porto, will be presented. At the end of the day, each participant should be able to choose one morphological approach. The participants will be divided into different groups according to the selected approach. In subsequent days, each group, advised by a supervisor, will apply the selected approach in the case study. On the last day, a comparison between the different approaches will be developed, demonstrating the potential and weaknesses of each approach, as well as the fundamental complementarities between them, bearing in mind an integrated utilization. The best performance(s) in the workshop will be rewarded with participation in ISUF 2015 – Rome, taking place on 22-26 September 2015.

The Organizing Committee of the workshop comprises Vítor Oliveira, co-ordinator (Universidade do Porto), David Viana (Escola Superior Gallaecia, Escola Superior Artística do Porto), Marco Maretto (Università degli Studi di Parma) and Teresa Marat-Mendes (Instituto Universitário de Lisboa). The Advisory Council is composed of Giancarlo Cataldi (Università degli Studi di Firenze), Giuseppe Strappa (Sapienza Università di Roma), Frederico de Holanda (Universidade de Brasilia) and Jeremy Whitehand (University of Birmingham).

The registration fees are 150 € (regular fee) and 100 € (student fee, including MSc and PhD students). The period for registration is open from 1 January to 31 May 2015. Information on the registration procedure is available at pnum.fe.up.pt/index.php/registration.