The Problem of Fire in Nineteenth Century British Cities: the Case of Glasgow

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INTRODUCTION

British urban historiography overwhelmingly associates fire with medieval and early modern times. Constructed of wooden houses with thatched roofs, closely packed into a small area, fire was a permanent fear facing cities, most notably London (1666), and towns, like Shipston-on-Stour (1478), Stratford-upon-Avon (1594 and 1595) and Warwick (1694), alike. In their database of fire disasters in English provincial towns, Jones, Porter and Turner identified more than 500 "major fires", that is those where ten or more houses were destroyed by a single outbreak, between 1500 and 1800. In the nineteenth century they recorded a further 99 fires, 82.8 per cent of which were concentrated during the first-half of the century (Jones, Porter and Turner 1984).

The database suggested a dramatic reduction in the number of multiple-house fires after 1760, a view since corroborated by Borsay (1989) and, with important qualifications, Pearson (2004). This decline has been ascribed to the building of "fireproof" cities through the substitution of brick and tile for timber and thatch as the main building materials and an increase in house lot size to prevent fire spread (Frost and Jones 1989). Of secondary importance was the role played by fire brigades, which were increasingly municipally owned enterprises that protected the entire urban population rather than insured property owners, improvements to water supplies, the diffusion of new power sources like steam traction, and the threat of discriminatory fire insurance premiums (Anderson 1979, Greenberg 2003).

Pearson (p. 33), however, is critical of the database, noting that it is incomplete, does not include the many destructive village fires, and ignores single building fires. The latter is of considerable significance when studying late eighteenth and nineteenth century fires as, while the number of multiple-house fires declined, the numbers of single property fires substantially increased, alongside rising rates of human casualties. Moreover, with higher values of stock and fixed capital within commercial and manufacturing buildings located in the growing cities of the industrial revolution, the definition of a "major fire" requires significant amendment.

There can, for example, be no doubt that London's Tooley Street fire of 1861, which destroyed warehouse property exceeding £2 million in value, killed the chief superintendent of the insurance-funded London Fire Engine Establishment, James Braidwood, and precipitated the establishment of the publicly-owned Metropolitan Fire Brigade and the adoption of stringent commercial building

regulations, was a major fire of considerable social, economic and cultural consequences (Blackstone 1957, pp. 160-1). Countless other large commercial, industrial, and even residential fires have been documented in English *and* Scottish cities for the nineteenth century (Holme, (ed.), 1844, Young 1866, Goad 1899, Gilbert 1901), the latter missing from Jones, Porter and Turner's study. Clearly then, fire continued to be "a major economic, social and existential problem" (Pearson, p. 35) and is a subject of increasing consequence for historians interested in the ways in which British cities handled the negative externalities of rapid urbanisation, and not just those of North America which, as with the prominent cases of Chicago (1871) and Boston (1872), have received extensive scholarly attention (Rosen 1986, Sawislak 1995 and Smith 1995).

Jones, Porter and Turner (p. 13) also conceded that their database was likely to be biased towards London and the south-west, regions which they were researching. Pearson's (pp. 33-4) survey of fires recorded in three monthly periodicals between 1730 and 1779 is also "strongly biased" towards London. Little is known of how the industrial cities of midland and northern England and Scotland coped with the fire risks of unregulated development, prevalent in those congested docklands, teeming factory and warehouse districts, and shoddily-built and overcrowded slum housing. The main growth centres of Liverpool, Manchester, Birmingham, Leeds and Glasgow were increasingly at risk from destructive fires, yet they are absent from historical accounts. In their analysis of large fires listed in *The Times Index*, Frost and Jones (pp. 341-2) deduce that Manchester "may well have embodied the worst faults of industrial cities, but fire risk was not among them," while "Liverpool experiences no major fire after 1739." A general search of the *Index*, however, reveals a "great fire" at the city's New Quay warehouses and a "destructive fire" at a ropeworks in 1870, another "great fire" in Errington Street in 1895, a "very destructive fire" in a factory in 1894, and numerous fatal fires, while Pearson (p. 51) notes that Jones, Porter and Turner missed the great fire of 1803 in the city's 'Goree' warehouse district. Although these outbreaks do not fulfil the authors' criteria for a "major fire", they cannot be discounted as being either capital-destructive or social fire shocks. Indeed, early Victorian Liverpool had "an unenviable notoriety" (Holme 1844, p. 3) for the frequency and extent of its dockland fires, which culminated in 1842 with the insurance companies colluding to raise mercantile and warehouse premiums by 83 per cent to recoup heavy losses suffered during preceding years (Pearson, p. 214).

Notwithstanding their methodological weaknesses, Jones, Porter and Turner (p. 59) conclude that a yawning "fire gap" emerged in nineteenth century England between the growing size of towns and the declining number of fire disasters. The limitations of this prevailing methodology are rooted in the authors' failure to recognise that the meaning of fire changed over time. The social and economic changes experienced by industrialising cities – including the continued growth of fire insurance, the piecemeal introduction of building regulations, the spread of non-combustible materials and new petrochemical and electrical hazards, the emergence of zoning within town planning, and the municipalisation of natural monopolies – created a new "urban fire regime" emphasised by the prevalence of single-unit property fires and the threat posed by fire to human

life, rather than the traditional conflagration defined by fire spread and the multiple destruction of houses. In short, the destructive capacity of modern urban fires was not simply measured by the number of buildings burned, thus any study of fires in industrial cities must adopt a much broader definition of what constitutes a "major fire". In incorporating the changing "ecology of fire" (Pyne 2001, pp. 112-5), future studies should include fires in factories, warehouses, theatres, department stores, as well as dwelling-house fires, all of which involved single property destruction, yet were considered major depending on the extent of human casualties, the financial losses incurred, and the impact they had as catalysts for reform.

Jones, Turner and Porter (pp. 58-9) lament the "impossibility of recovering data on the burning of houses singly or in very small numbers," suggesting that to attempt such a task would be "endless" and "never remotely complete." This is true for the earlier period of their study, yet the nineteenth century provides fruitful sources from which an extensive, if not wholly complete, pattern can be drawn. The growth of the daily press, with an explosion in the number of provincial newspapers during the late eighteenth century, provides a fundamental resource for the reporting of small fires on an almost daily basis, that is those where fewer than ten buildings were destroyed or damaged. Supplemented by contemporary published compendiums by leading municipal officials, engineers and firemen, a general quantitative and qualitative picture of urban fires can be built to plug a knowledge gap about the causes of fire and their consequences for urban development. Focusing on Glasgow I will shed light on the city's chief fire risks and the ways in which public and private authorities sought to control its devastating impact.

VICTORIAN GLASGOW: "TINDERBOX CITY"

Victorian Glasgow – the largest town in Scotland from 1821 and the heart of the country's industrial and commercial wealth – provides an important case study for assessing the enduring impact of fire because it comprised a diverse range of risks associated with its growth as a major international manufacturing and commercial centre. These encompassed general risks, including warehouses, shops, workrooms and offices; mercantile risks, including wharves, quays and stores handling merchandise like grain, flour, sugar, tea and tobacco; shipbuilding risks along the banks of the River Clyde and at sea; engineering, metal and wood-working risks, including sawmills, cotton mills and machine tool factories, and the manufacture of all kinds of marine engines, cranks, pumps and valves for the shipbuilding industry (Remington 1928, pp. 204-7). They also, however, included notorious domestic risks, especially those densely-packed working-class tenement districts comprised of "ill-ventilated, high-piled, waterless and dilapidated houses" (Rodger 1986, p. 152) and, more peculiarly to Glasgow, the four- or five-storeyed tenement factories with their "ever-present hazard of fire spreading from one lessee to the rest (Watson in Stell, Shaw and Storrier, (eds) 2003, p. 539)." As a city undergoing phenomenal rates of urban growth – its population increasing more than fivefold between 1801 and 1861, and virtually doubling again to 784,496 by 1911 – within its bursting medieval limits until boundary extensions in 1872, 1891 and 1912,

Glasgow's problems from overcrowding, poverty and disease have been well-documented (Allan 1965, Maver 2000). However, with the exception of a series of destructive cotton mill fires from 1838-43, which has been identified as indicative of the decline of the city's textiles industry (Robertson 1970, p. 118), and, contemporaneously, the use of discriminatory insurance premiums to force the adoption of fireproofing in warehouses and municipal improvements to fire services (Pearson, pp. 214-5), fire has been absent from Victorian Glasgow's economic and social history.

Frost and Jones (p. 337) write that "Logically, one would expect a substantial rise in the number of city dwellers and buildings to be accompanied by a similar rise in the number of major fires, but this did not occur." Equally, one might deduce from their results that, logically, one would expect a fall, however slight, in the aggregate number of fires in Victorian cities that continued to expand while embracing fireproof materials. Yet this too never occurred. Indeed, the number of fires reported to the municipal fire brigade, which was originally established in 1807, more than doubled in Glasgow from an annual mean of 265 from 1855-70 to 538 from 1885-1900 (**table 1**).

Table 1. Mean number of fires reported to Glasgow Fire Brigade,
1855-1900 (Watson 1864-70, Marwick 1901)

1855-1870	265
1870-1885	341
1885-1900	538

Even allowing for the city's continued population growth, and the extension of the municipal boundaries, the annual number of fires, expressed per 10,000 of the city's population, increased from an average of 7.02 in 1855-65 to 9.85 in 1895-1905, having experienced a rising trend for most of the period (**fig. 1**).

How do we account for these rising figures? William Watson (1866, p. 67), the mid-Victorian city chamberlain, was "not aware that there is any reason to attribute this increase to any improper cause, but rather to the increase in the number of manufacturing processes, the greater crowding together of workshops, and the universal use of gas." Analysis reveals that domestic fires clearly accounted for an increasing proportion of Glasgow's fires, rising from a fifth of all fires in the 1850s to a third in the 1870s and 1880s, ranging between a third and a half by the 1890s (**table 2**). The great majority of these single-unit fires were classified as "trifling" by contemporaries, not least the brigade's firemaster (chief officer) in his annual reports, their extinguishment only requiring firemen using buckets of water, without recourse to fire engines or even hose reels (GCA E1/14/1, 5 January 1866, pp. 306-7). However, domestic fires do not account for the whole, suggesting that a number of workplace fires would have also been 'trifling' affairs. Indeed, not all domestic fires were labelled "trifling", some being considered serious inasmuch as they involved either the complete destruction of the house, spread to adjoining properties, or caused loss of life. Thus,

reporting on the 136 house fires in 1881, Firemaster Bryson noted two exceptional outbreaks, one being caused by a gas explosion and the other involving the destruction of a tenement after spreading from an adjoining factory (*Ibid*, 13 January 1882, pp. 188-90).
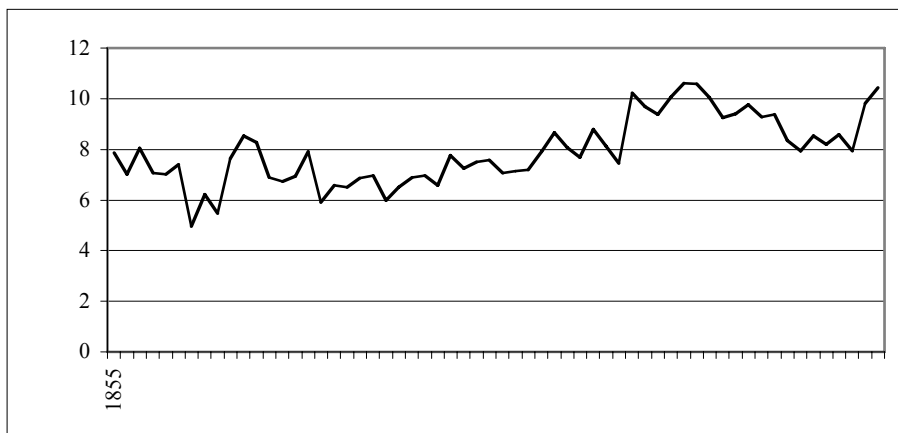

Figure 1. Fires reported to Glasgow Fire Brigade within the city boundaries, per 10,000 population, 1855-1914 (as Table 1 and GCA E2/6)

Table 2. Proportion of domestic and 'trifling' fires in Glasgow, 1855-1900 (as fig. 1)

	Domestic fires, %	Trifling fires, %	Total
1855	19.47	-	262
1865	28.20	-	344
1875	32.16	50.00	342
1885	30.39	39.23	362
1895	41.28	38.00	671
1900	39.86	37.27	695

Glasgow was unexceptional in suffering from high proportions of small, but inconvenient, domestic fires. Edinburgh, for instance, experienced extremely high levels throughout the nineteenth century (**table 3**). This is largely explained by the prevalence of hearth and chimney fires, a nuisance which required the chimney wall to be forced open, or "slapt", to allow the smoke to bypass the blocked chimney stalk. A crippling problem before strict licensing rules were adopted for the capital's chimney-sweeps in 1848 (ECC 1849), the city authorities had managed to reduce the problem to a manageable proportion by the late nineteenth century, assisted in no small part by the introduction of fines for those causing chimney fires in 1892 (Bell 1919, p. 26).

Table 3. Domestic and chimney fires in Edinburgh, 1831-1911 (LBFRS)

	Sample of fires	Domestic fires, %	Caused by foul vent or chimney, %
1831	359	74.93	72.14
1851	88	55.68	43.18
1871	98	45.92	29.59
1891	328	54.27	37.20
1911	204	58.33	28.92

Unswept chimneys and poorly constructed hearths and vents were, then, one of the chief causes of fire in nineteenth century Scottish cities, indicating the prevalence of cheaply constructed tenements, the absence of appropriate building controls, and the central role played by the open fireplace in the Victorian home: recognised popularly as the primary ventilating agent in most homes, as well as the main source of heating, cooking and lighting, discourses of domestication centred on the control of fire through the hearth (Mosley 2003, Pyne 2001, pp. 103-4). However, as arguably the main health risk within the home, and as a public nuisance through the pungent smell of burning soot and its promiscuous belching of large flakes (Young 1866, p. 4), controls over the construction of chimney hearths and vents, in English cities especially, were strengthened during the nineteenth century through adoptive building by-laws.

Scottish cities were, however, slower to respond to this tightening of controls despite complaints from the 1860s and 1870s of the "numerous" fires caused through timber being laid directly under the hearthstone, unbridled joists, or wooden wall linings being fitted close to fireplaces (GCA TD338/7/1, 6 April 1874, pp. 7-8; 2 October 1874, p. 49). Others bemoaned the "prevailing taste" for installing low-lying fire grates in houses, which placed the burning fuel precariously close to the floor (Watson 1866, p. 87). Indeed, it was calculated in 1877 that about 58 per cent of house fires occurred through defective vents and fireplaces (GCA TD338/7/1, 15 January 1878, p. 181). Early legislation, establishing Glasgow's improvement trust, sought to tackle the city's overcrowded and disease-ridden slums without any attention to fire (Allan 1965). A provisional order to strengthen Glasgow's building regulations in 1879 was defeated by a powerful group of landlords, architects and procurators who resented the additional cost implications of the proposals (Barras 1894, p. 156). Only in 1892, with the Glasgow Building Regulations Act, was it prescribed that no timber joist was to be closer than four-and-a-half inches to any chimney opening to reduce the risk of fire (*Ibid*, pp. 168-9), yet in England the 1877 Model by-laws had stipulated nine inches to be the rule. Even then Glasgow lagged behind current architectural practice, as just two years later the 1894 London Building Act strengthened the metropolitan building regulations by insisting that timber be no nearer than twelve inches to the inside of the flue, or within ten inches of the hearth surface (Harper 1985, p. xxvii).

In Glasgow, by the mid-1880s, the crippling threat posed from defective construction culminated in a campaign by the local insurance industry and the new firemaster, William Paterson, formerly inspector of factories in London before his appointment in 1884, to lobby directly the municipal authorities to promote a "well-worded and worked Building Act" through which this "evil" could be lessened. Whilst highlighting the risks posed by inflammable flooring and weak supporting walls, the neglect to insulate steam boilers and gas engines, and the careless storage of combustibles like naphtha and petroleum, Paterson asserted that these remained secondary causes of fire. Broadening his campaign, Paterson made critical public speeches to such bodies as the Insurance and Actuarial Society of Glasgow in which he deplored the architectural and building industries' failure to regulate themselves:

> He wished […] to draw the attention of architects and builders to the gross carelessness and want of thought in many buildings. Not only were gables and party-walls in many cases not carried about the roofs, but joists were put into chimneys, hearth-stones were checked into the joists instead of being at the expense of bridling and arching. Workmen were often careless, and drove dooks into chimneys. Some would say these were small matters, but they were often the cause of large fires. But the remedy was a simple one. Architects should study causes of fires, and the means of keeping them within moderate dimensions.

> (*The Fireman*, 1 March 1888, p. 164)

Proposals were mooted that Glasgow should appoint a buildings inspector to enforce compliance with any new regulations, otherwise it would be "exceedingly difficult to get architects to pay any attention to the subjects mentioned (*Ibid*)." In his annual report for 1889, Paterson strengthened his case by warning of "an epidemic of serious fires" continuing unabated "until stringent regulations can be enforced by the Local Authority (GCA E2/6, Annual Reports 1889, p. 4, 1891, p. 4)."

Following the creation of a standard Glasgow tariff in 1846, the insurance industry's interests were co-ordinated locally by a fire insurance rate committee, later renamed the Glasgow Rate and Salvage Association (GRSA). This committee, responsible for tariff enforcement, comprised representatives from the various companies conducting business in the city. By 1873, under pressure from the London and Edinburgh head-offices alarmed by "the numerous and serious fires that have occurred in Glasgow" and their near total losses, the GRSA formed a salvage corps, which, learning from the experience of similar bodies in London and Liverpool, rescued salvageable stock, machinery and furniture from the city's many burning buildings. Having faced initial hostility from the municipality and Firemaster Bryson, who feared an intrusion into his brigade's work, the salvage corps had, by the 1880s, carved out a prominent role in protecting the city's property (GCA TD338/17/7, 8 December 1873, pp. 15-7; Gispert 1997).

In two reports on the menace facing Glasgow's businesses, the superintendent of the corps, Edwin Goodchild, a former London fireman, identified three lamentable fire risks requiring drastic attention: firstly, the common practice of laying hearthstones on wooden joists; secondly, the preference for timber mantelpieces rather than jambs of stone or slate; and thirdly, the poor maintenance of unused fire-places, which, rather than being bricked-up, were boarded-up, papered over, or filled with rubbish, with sparks from neighbouring chimneys commonly falling into them and causing fires (GCA TD338/4/1, April 1875, p. 30, 2 March 1886, p. 29). The effect of these defects was that the proportion of fires caused by defective construction was substantially higher in Glasgow, at 27.80 per cent from 1874-84, than in London and Liverpool, where construction was more stringently regulated, and, significantly still, in Manchester (**table 4**). However, that Goodchild's two reports, written in 1875 and 1886, were virtually identical, and despite his ideas receiving attention from the local and trades press, indicates that few improvements were implemented in the decade separating them.

Table 4. Number and proportion of fires caused by defective construction of hearths, fireplaces and vents 1874-84 (GCA TD338/4/1, 2 March 1886, p. 29)

City	Number of fires	Defective hearths	Timber and other defects in vents or fireplaces	% of total
London	18 292	123	1643	9.65
Liverpool	4 070	130	370	12.29
Manchester	2 968		644	21.70
Glasgow	3 500	228	745	27.80

The intensification of Paterson and Goodchild's reform campaign was assisted by a series of disastrous fires in the city's large warehouses between 1886-89, including the complete destruction of a general drapers' warehouse in the Cowcaddens district, with losses estimated at £20 000 (*The Scotsman*, 9 March 1889), which forced the city authorities to finally concede to the adoption of tougher building regulations. The decision, though, to promote a local Bill adopting those detailed measures enforced for some years in England was heavily influenced by John Carrick, the master of works and city architect, who had enjoyed close working relations with the firemaster since the mid-1860s (GCA E1/14/1, 27 April 1866, pp. 336-7) and was committed to raising the standards of Glasgow's new buildings. Through his connections with the lord dean of guild court, whose feudal powers had been resurrected in 1862 to supervise new building (Rodger, pp. 185-6), Carrick and his successors exercised considerable influence over the court's rulings on buildings' fire prevention and sanitation (*Glasgow Herald*, 25 September 1891, 27 February 1901).

Such officials were, therefore, empowered through their vastly superior knowledge of construction to impose costly technical conditions on builders. When in 1888 the lord dean moved for prescriptive measures strengthening the foundations, walls and heights of new buildings, especially

"all warehouses intended for valuable combustible goods," he based his views on more than his personal experience. The "most important" recommendation made was that "the utmost care ought to be exercised when joisting or any wood is necessarily brought contiguous to fireplaces or vents," with all hearths placed on brick arches (*The Fireman*, 1 December 1888, p. 113, Barras, p. 159). Thus, whether directly or through an intermediary, Paterson had secured the ear of the Court, his concerted campaign finally achieving its objectives.

The Glasgow Building Act, 1892, coupled with adoption of the Factory and Workshops Acts, 1891 and 1895, forced businesses to seriously consider fire safety measures. All workplaces employing over forty persons were subjected to stringent regulations regarding means of access and the storage of hazardous materials, while the rules governing hearth and fireplace construction were rigidly enforced. Such powers of licensing were, with the agreement of the medical officer of health who considered them beyond the scope of public health, jointly invested with the firemaster and master of works, their decisions acting as *fait accompli* for the fire brigade sub-committee – which acted as sanitary authority – and the lord dean (GCA E1/22/1, 21 October 1892, pp. 23-4).

The legislative changes also strengthened the insurance industry's case for adopting more punitive rates. The salvage corps was directed to inspect the quality of building construction in the city's warehouses and factories, the evidence of which helped frame a four-class sliding scale of insurance in 1898 (GCA TD338/4/4). A systematic sample of the data recorded for 100 warehouse inspections between 1891 and 1898 produced a total of 712 hazards (**table 5**), the sheer volume justifying the tightening of the city's building regulations. Moreover, evidence demonstrated that the city's traditional problem with defective hearths and vents, whilst not eradicated entirely, was brought under closer control by the regulations. However, the overwhelming predominance of unused or boarded-up fireplaces and defective gas fittings, at 35.67 and 31.04 per cent respectively, was a worrying indictment of the legislation's failure to effectively tackle either problem. Gas fittings, the majority of which were constructed from soft metal pipes prone to melt, posed an increasing hazard during the second-half of the nineteenth century, yet proposals to compel warehouses and public works to install iron pipes were not implemented, while proprietors continued to ignore advice to properly seal unused fireplaces.

Table 5. Fire safety defects in Glasgow and Paisley warehouses, 1891-98, % (GCA TD338/4/3)

Unused or boarded-up fireplaces	35.67
Defective gas fittings	31.04
Stock or rubbish lying unattended	9.83
Insecurely fitted gas stoves, pipes and boilers	9.55
Open joint or timber in hearth	6.88
Other	7.02

Why, then, was Glasgow slow to tackle the fire menace of defective construction? Wermiel (1993) suggests that American architects were quicker than their British counterparts to adopt fireproof construction during the nineteenth century due to their heightened anxieties about the dangers of fire. Although examples of mills, factories and warehouses that adopted fireproofing methods, especially cast- or wrought-iron beams, have been documented for Glasgow, the absence of any national strategy for the promotion of fireproofing undoubtedly testifies to an *ad hoc* approach dependent on individual attitudes and local resources (Watson in Stell, Shaw and Storrier, (eds.), pp. 512-7). Moreover, British suspicion of fireproofing had been realised in London's Tooley Street (1861) and Cripplegate (1897) fires, where the cast-iron columns had fractured under extreme heat. Experience created an oppositional attitude amongst leading firemen, with both James Braidwood and Eyre Massey Shaw, London's most senior officers, criticising fireproofing, an attitude which doubtless influenced provincial firemen like the apprentice-joiner James Bryson, the long-serving firemaster in Glasgow (1855-84). William Paterson, Bryson's successor, on the other hand, perfectly represented a new generation of late Victorian technically proficient engineer-firemen predisposed towards fire prevention, much like Birmingham's notorious Tozer fire-fighting dynasty (Ewen 2005 and forthcoming).

Victorian Glasgow faced significant fire risks, yet rather than compelling builders and architects to incorporate fireproofing into new buildings, its municipal authorities only intervened in the built environment on a public health platform, establishing the city's improvement trust to undertake comprehensive slum clearing from 1866. The municipality preferred to invest in its fire extinction capabilities, including providing water on the high-pressure gravitation system, which, combined with an extensive fire hydrant network, meant that firemen could connect their hose directly to a hydrant without having to use an engine in most outbreaks (Steven 1975, p. 37). Of course, this non-intervention in building regulations could backfire, as it did when a strike of plasterers in 1876 caused practically all the buildings erected in the city during that period of the city's 1873-77 "tenement-building boom" to be lined with wood throughout, which significantly intensified the risk of combustion, a large proportion of them burning down shortly thereafter (Remington p. 205, Glendinning in Stell, Shaw and Storrier, (eds.), p. 113). Moreover, the feudal land system and propensity of small-scale building firms, combined with the working-class preference for cheap rented housing, meant that minimum regulations were difficult to enforce as they drove up construction and rental costs (Rodger). Finally, the absence of a thoroughly co-ordinated insurance presence before the 1870s weakened that industry's attempts to influence policy, unlike in London and Liverpool where there was a stronger tradition of inter-company co-operation (Pearson, pp. 213-5).

This appears to substantiate the causal linkage identified by Gaskell (1983) and Harper (1985) between the public health movement and improvements to urban housing from the 1840s. Urbanisation forced local authorities to consider the relationship between disease, sanitation and building, forcing them to "move beyond minimal controls for preventing the collapse of buildings,

controlling the risk of fire and limiting those nuisances affecting the general public (Gaskell, p. 19)." Although early legislation, notably the London and Edinburgh Acts of the seventeenth and eighteenth centuries, was framed by the devastating impact of large conflagrations on the urban landscape, Victorian regulations were increasingly shaped by public health discourses associated with the provision of light and air into Britain's slums. Such a view, however, understates the importance of fire as a mitigating factor behind many of the building regulations devised from the 1840s. For example, where adopted, the Towns Improvement Clauses Act, 1847, stipulated the carrying of party walls through and above roofs to reduce the threat of fire spread, as well as the construction of walls and roofs of incombustible materials, while the Burgh Police (Scotland) Acts, 1850 and 1862, contained similar adoptive measures (Hamilton 1958).

In truth building regulations were concerned with designing out both disease *and* fire. Glasgow provides a telling example of this interdependence. Its 1892 Act, further strengthened in 1900 with the prescribed installation of "fire-resisting divisions" in large mixed-use buildings, certainly recognised that fire was a critical threat to the city's rampant unregulated expansion, yet simultaneously targeted sanitary improvements to its working-class tenements. In so doing, by the turn of the twentieth century Glasgow enjoyed some of the most demanding building regulations in Britain, insisting upon firm foundations, thick walls, stiff roofing materials and a high load-bearing capacity in tenements and warehouses alike. These regulations had a dual effect on local construction. Firstly, they had a long-term impact on the destructive capacity of fires, wherein fire was more likely to be contained within a single room, rather than spread to other rooms or adjoining properties. Secondly, as argued by a number of experts like Thomas Binnie, the local property magnate, in evidence to the municipality's commission on the housing of the poor in 1904, while "the strict enforcement of building regulations intended to make buildings more substantial and healthier," by raising building standards and improving sanitation, it had inevitably increased the construction and rental costs of working-class housing (Glasgow Municipal Commission 1904, p. 304(6458)).

CONCLUSION

Victorian cities have been conventionally viewed as "reservoirs of disease, crime and vice," (Allan, p. 598) yet this paper has argued that fire should also be considered as an enduring problem facing public and private authorities alike. The declining number of fires involving the destruction of ten or more houses is an unsatisfactory measure of the impact of fire on modern urban development. The cultural meaning of risk, the prevalence of factory, mill and warehouse fires, the rising numbers of single-unit fires, and fires involving human casualties each have to be incorporated within any appropriate definition of a "major fire". Local or even national characteristics, such as the Scottish tenement system and Glasgow's building codes, also influenced the scale and frequency of fires. Victorian Glasgow's reputation as a "tinderbox city" (Gispert p. 39) thus challenges the view that the threat posed by fire declined during the nineteenth century.

Moreover, the prevailing view that market forces failed to improve environmental conditions, especially in housing and sanitation, which precipitated the piecemeal municipalisation of natural monopolies like water and other local services, requires some qualification. As this case study has shown, moves to improve the fireproofing of Glasgow's commercial and domestic buildings were initiated jointly by public and private actors, including the fire brigade's firemaster, the master of works, the lord dean of guild court and, crucially, the Glasgow Rate and Salvage Association. Doubtless influenced by rising losses, but also by a social conscience, the insurance industry certainly played a major role in improving and popularising fire prevention in London, Liverpool and Glasgow. In sum, the constant presence of fire, or risk thereof, within the industrial city underpinned nineteenth century urban change, whether consciously or not. From its architecture to its working practices and domestic habitat, the Victorian built landscape remained an undeniable fire environment: "Cities are and have always been fire places (Pyne, p. 102)."

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