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Reconstructing the Original Height of Zhang Zeduan's Along the River During the Qingming Festival

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Abstract

The Palace Museum version of Zhang Zeduan's *Along the River During the Qingming Festival* (*Qingming Shanghe Tu*) currently measures 24.8 cm in height. Image-based dimensional analysis indicates that the original vertical dimension was greater. Using the intact crane of the south-bank huabiao as an internal scale reference (crane-to-cross-arm ratio 1.66), the truncated north-bank crane yields an upper-edge deficit of at least 9.5 mm, likely 10–16 mm allowing for a composition margin. Nine independent truncation indicators along both edges give losses of 3.0-10.2 mm, the most reliable clustering near 9.5 mm. The results converge on a total vertical loss of approximately 30–32 mm, implying an original height of 278–280 mm, consistent with Li Dongyang's 1515 record that the painting was "less than one chi" high. The findings indicate that the present format is unlikely to be the artist's original format, with consequences for conservation, digital reconstruction, and for interpretations resting on the cropped edges.

1. Introduction

The Palace Museum version of *Along the River During the Qingming Festival* (*Qingming Shanghe Tu*, hereafter QSHT), attributed to the Northern Song painter Zhang Zeduan (fl. early twelfth century), is a handscroll in ink and colour on silk now 24.8 cm high and 528.7 cm long[5,6], the standard object against which the scroll's authorship and date have been anchored by the colophon of Zhang Zhu (1186) and by later Ming connoisseurs such as Li Dongyang and Shao Bao[5]. It is among the most studied objects in world art history[1–4], and a substantial English-language scholarship now surrounds it. Hansen[1] argued that the city shown is not Kaifeng but an idealized city, that the painting postdates the fall of the Northern Song, and that *qingming* denotes "peace and order" rather than the festival; Tsao[2] and Itō and Yoshida[3] offered further interpretive readings of the scroll's relation to Northern Song politics and society.

Questions about the completeness of the scroll have a long historiography. Li Dongyang's colophon of 1515 states that the painting was "less than one chi in height and more than two zhang in length" (□□□□□, □□□□□) and describes, among the scenes he saw, mountains that rise and fall (□□□□□□, □□□□) — topography that is entirely absent from the surviving scroll, whose opening section is given to rural paths and fields[5,8]. On this basis several scholars have argued that the front of the scroll, containing landscape, has been lost[7]. In the opposite direction, Yu Hui has argued, on the strength of a detailed examination of the colophons and the pictorial sequence, that the image itself is essentially complete and that what was lost is mainly the Ming-dynasty inscription by Shao Bao; he attributes the fact that the characters of Zhang Zhu's 1186 colophon reach the top and bottom edges of the paper to the calligrapher's own layout rather than to trimming[5].

A third, largely unnoticed class of evidence bears directly on this debate: the motifs of the painting themselves are repeatedly cut by the upper and lower edges of the paper. In the present paper we

document these truncations, measure them, and use an internal scale reference — the proportion between the crane and the cross-arm of the intact huabiao (ornamental pillar) on the south bank of the Hongqiao bridge — to estimate how much of the vertical dimension has been lost. The question is not merely art-historical. Handscrolls are physical objects whose supports have been trimmed, patched, and remounted over centuries of conservation; knowing the original dimensions of the support bears directly on conservation documentation, on the interpretation of composition, and on digital reconstruction, an active topic in heritage science[9–12]. The aim of this study is therefore (i) to produce a systematic inventory of vertical truncation indicators within the painted image; (ii) to estimate the missing vertical dimension quantitatively from the huabiao-crane geometry; and (iii) to cross-validate the estimate against period written records and against the vertical dimensions of later versions of the composition.

2. Materials and methods

2.1 Object and image materials

The subject of this study is the Palace Museum version of QSHT, ink and colour on silk, 24.8 × 528.7 cm[5,6]. Measurements were carried out on the high-resolution digital reproductions published by the Palace Museum and on the super-resolution reconstruction dataset produced for this painting by Wang et al.[12]. All distances were measured on screen in a raster graphics editor at magnifications such that 1 mm of the object corresponded to no fewer than 30 pixels (typical working zoom 8–16×). Because the physical height of the scroll (248 mm) is known(Fig. 1), the pixel scale along the vertical axis was calibrated directly against it, and all reported values are object-plane millimetres. Each length was measured three times by the same operator in three separate sessions; reported values are the means, and the half-range of the three readings is reported as the measurement uncertainty (± 0.5 mm unless otherwise stated). Measurements of individual motifs are illustrated in Figs. 2 and 3 and summarized in Table 1.

Table 1
Inventory of vertical truncation indicators in the Palace Museum version of QSHT

No.	Motif	Location in scroll	Edge	Evidence base for complete form	Measured values (mm)	Estimated deficit (mm)
1	Crane of the north-bank huabiao	Hongqiao, north bridgehead	Upper	Intact crane of the south-bank huabiao (h/d = 1.66)	D = 6.9; H = 11.45; L = 2.0	9.45 (10.2 at paper edge)
2	Signboard characters (“□ □□□□”)	Shop near the river market	Upper	Character module height from intact characters	2.5 characters × ~3.6	≈ 9.0
3	Temple chiwen (close view)	Roof of a temple	Upper	Chiwen norm; surviving 1.5 mm of ~ 7 mm form	7.0 − 1.5	5.5
4	Wine-shop banner	Wine shop on the bank	Upper	Banner extent from intact similar banners	—	≈ 5.0
5	Temple ridge ornament (distant view)	Temple in the opening section	Upper	Ridge ornament norm	—	≈ 3.0
6	Man (lower body cut)	Bank near the river	Lower	Complete figure height 27.5; surviving 18	27.5 − 18	9.5 (alt. 9.2)
7	Horse (hind legs cut)	Riverbank in the market	Lower	Hip height ~ 20.5; hoof line 11 from edge	20.5 − 11	≈ 9.5
8	Man in ox-cart scene	Road in the countryside section	Lower	Complete figure norm	—	9.5
9	Zhang Zhu colophon characters	Tail paper, colophon of 1186	Upper + lower	Characters reach both paper edges (“dingtian lidi”)	Colophon block fills 248 mm strip	qualitative

2.2 The huabiao-crane scale reference

On both sides of the Hongqiao bridge, near the bridgeheads, the painter shows a tall wooden pole carrying a short horizontal cross-arm at its top, with a bird perched on the cross-arm (Figs. 2, 3). The function and identity of these devices have been debated; the balance of scholarship identifies the poles as huabiao-type markers and the birds as cranes, not wind vanes, on the basis of comparable depictions in period painting and of textual evidence[13–16]. For our purposes the decisive fact is that the device is drawn in the same form on both banks, and that on the south bank both the pole-and-cross assembly

and the crane are intact, whereas on the north bank the upper part of the crane is cut by the edge of the paper (Fig. 3).

On the intact south-bank devices, the ratio between the vertical distance from the crane's beak tip to the centre of the cross-arm, h, and the length of the cross-arm, d, was measured as h/d = 1.66 (mean of the two south-bank cranes; individual values 1.62 and 1.70). This proportion is consistent with the posture of cranes shown standing on poles or pillars in other Northern Song and Yuan figure painting, for example the cranes in Wang Zhenpeng's (thirteenth-century) handscroll depictions of sacred-mountain processions, in which the same beak-to-cross geometry recurs(Fig. 8); it is therefore treated here as a stable, painterly, in-plane scale reference rather than as a measured anatomical constant.

2.3 Reconstruction of the truncated north-bank crane

Because the painter used the same device form on both banks, the same proportion should hold for the north-bank crane. If D is the measured length of the north-bank cross-arm, the height of the crane beak tip above the cross-arm centre, H, is given by

$$H = (h/d) \times D \quad (1)$$

and the vertical deficit at the motif, δ, is

$$\delta = H - L \quad (2)$$

where L is the distance from the centre of the cross-arm to the present upper edge of the paper along the vertical through the motif. D was measured as 6.9 mm, giving H = 11.45 mm; with L = 2.0 mm, δ = 9.45 mm ≈ 9.5 mm. The direct measurement of the truncated portion at this position along the paper edge is 10.2 mm, in close agreement once the slight slope of the local paper edge is taken into account (Fig. 3). A nominal composition margin of 6 mm, of the kind normally left between a finished motif and the edge of a Song painting, raises the implied upper-edge loss at this location to approximately 15–16 mm; this margin is treated as an assumption and reported separately from the geometric minimum.

2.4 Truncation-indicator inventory

Each motif whose complete form can be reconstructed from the painting itself — from a duplicate, from the same element elsewhere in the composition, or from a well-attested iconographic norm — was measured independently. The indicators are listed in Table 1 with their evidence bases and values. Indicators were classified as upper-edge (U) or lower-edge (L) according to the edge that cuts the motif.

2.5 Historical sources and metrology

The written records used for cross-validation are the colophons of Zhang Zhu (1186) and Li Dongyang (1515), the latter reproduced and discussed by Yu Hui[5]. For the conversion of the period chi, we use the documented lengths of Northern Song rulers, 30.9–32.9 cm (ordinarily about 31 cm)[17], and of the Northern Song yingzao chi, approximately 32 cm[18]; the Ming-dynasty tailor's chi used in the Ming records

is approximately 34.1 cm^5. Because the several chi standards of the period differ by only a few per cent, the historical constraint used here is the inequality “height less than one chi” (i.e. less than roughly 31–34 cm), which is robust to the choice of standard.

3. Results

3.1 Inventory of truncation indicators

Nine independent motifs are cut by the upper or lower edge of the painting paper (Table 1; Figs. 2, 3, 6, 9). They include three architectural elements (the crane of the north-bank huabiao; the chiwen ridge ornaments of a temple, both in close and distant views), two signboards and one wine-shop banner whose characters are truncated, and two human and one equestrian figure whose lower bodies or hind legs are cut by the lower edge. In every case the complete form is inferable from the painting itself or from an attested norm, so the deficit can be estimated without recourse to external data.

3.2 Huabiao-crane reconstruction

The reconstruction of Section 2.3 gives a geometric deficit of 9.45 mm at the north-bank huabiao (Fig. 3); the direct measurement of the truncated height at the paper edge at this position is 10.2 mm. This is the most precise single estimate in the dataset, because it is anchored to an intact duplicate of the same device only a few hundred metres away in the same composition.

3.3 Magnitude and consistency of the deficits

The nine indicators yield deficits of 3.0-10.2 mm (Fig. 4). The lower-edge indicators are tightly clustered: the man whose lower body is cut (9.5 mm; alternative estimate 9.2 mm) and the horse whose hind legs are cut (9.5 mm) imply a lower-edge loss of approximately 9.2–9.5 mm. The upper-edge indicators are more scattered (3.0-10.2 mm), but the two most reliable — the crane reconstruction (9.45–10.2 mm) and the signboard whose two and a half characters are cut (≈ 9 mm) — again fall near 9.5 mm. The remaining upper-edge values (temple chiwen 5.5 mm; distant temple ridge 3 mm; wine-shop banner 5 mm) are smaller and plausibly reflect motifs that were already set further from the original edge, or local secondary damage; they are retained here as lower bounds. The mean of the four most reliable estimates (crane, signboard, man, horse) is 9.4 mm (range 9.0-10.2 mm).

3.4 Estimated total vertical loss and original height

Two defensible readings of the data are as follows. (i) A minimum reading adds the lower-edge loss (≈ 9.5 mm) to the geometric upper-edge minimum (≥ 9.5 mm), giving a total vertical loss of at least 19 mm and an original height of at least 267 mm. (ii) If, as the convergence of the most reliable indicators suggests, both edges were trimmed by approximately 9.5–16 mm (the upper bound including the 6 mm composition margin), the total loss is approximately 30–32 mm, giving an original height of approximately 278–280 mm. We take the second reading as the central estimate, on the grounds that

the edge-trimming of a handscroll support removes a strip of similar width along its whole run, and that the smaller upper-edge values are explicable as locally less-affected stretches. The central estimate implies that 11–13% of the original height of the support has been lost. The present and reconstructed formats are compared schematically in Fig. 7.

3.5 Comparative vertical dimensions of later versions

The two most important later versions of the composition are taller than the Song original in its present state: the Ming-dynasty Qiu Ying-school version in the Liaoning Provincial Museum measures 30.5 cm in height[19], and the Qing court version of 1736 in the National Palace Museum, Taipei, 35.6 cm[20] (Table 2; Fig. 5). Figure 5 assembles on a single vertical scale the dimensions presented here — the present height (248 mm), the reconstructed original height (278–280 mm), Li Dongyang's "less than one chi" upper bound (310–340 mm), and the heights of the Ming (305 mm) and Qing (356 mm) versions. The reconstructed value falls between the present height and every later version, and below the period upper bound — the ordering expected if the Song scroll lost vertical material after the composition was fixed. Whatever their exact genealogical relation22, their consistently greater heights are consistent with the view that the Song version has lost vertical material, and inconsistent with the view that 24.8 cm represents an originally complete format. Period handscroll heights varied widely (roughly 20–55 cm), so we do not rely on "typical" Song heights as primary evidence; the comparison with the versions is corroborative only.

Table 2
Comparative vertical dimensions of the principal versions of the composition

Version	Date	Support	Height (cm)	Length (cm)	Source
Song original (Palace Museum, Beijing) — present state	Northern Song (c. 12th c.)	Silk	24.8	528.7	refs. 5, 6
Song original — reconstructed in this study	—	Silk	≈ 27.8–28.0	—	this study
Qiu Ying-school version (Liaoning Provincial Museum)	Ming (16th c.)	Silk	30.5	987	ref. 19
Qing court version (National Palace Museum, Taipei)	Qing, 1736	Silk	35.6	1152.8	ref. 20

3.6 Historical cross-validation

Two independent written records bound the estimate from above and from below. First, Li Dongyang's colophon of 1515 records that the painting was "less than one chi in height"[5]; with Northern Song chi standards of 30.9–32.9 cm[17,18], any original height below roughly 31–34 cm is consistent with the record, and our central estimate of 278–280 mm satisfies it (Fig. 5). Second, the colophon paper of Zhang Zhu (1186), on which the characters of the inscription fill the strip from top to bottom with no

blank margin — a condition that Dai Liqiang described as “dingtian lidi” (filling the heaven and touching the earth) and took as evidence that the strip had been trimmed — implies an original paper height of approximately 278 mm if the colophon block is reconstructed to its full extent[5,21]. If, as is customary for such tail inscriptions, the colophon paper was cut to the same height as the painting support, this figure independently reproduces our central estimate of the original painting height to within a few millimetres.

4. Discussion

4.1 Trimming during remounting as the mechanism

The pattern we document — a coherent set of motifs cut at both edges, with the lower edge affected almost uniformly by ~ 9.5 mm and the upper edge by a similar or larger amount at the most reliable positions — is what would be expected when the support of a handscroll has been trimmed during remounting. Chinese handscrolls are mounted on a backing and rolled for storage; each remounting exposes the edges of the painting paper to trimming and to the wear of the roller, and ancient silk, its fibroin degraded by centuries of hydrolysis and oxidation, loses tensile strength and frays preferentially at exactly these edges[9,10,11,13]. The documented history of QSHT includes at least five remountings, the first during the Ming dynasty in the collection of Li Xian and the most recent by the Palace Museum conservation workshop in 1973[5]. Even a few millimetres removed at each of these events would accumulate to the 30–32 mm reconstructed here. The longitudinal (length) dimension is protected by the same mounting practice that sacrifices the edges, which explains why the celebrated 528.7 cm length survives essentially intact while the vertical dimension has been progressively reduced.

4.2 Engagement with the opposing view

Yu Hui, the most detailed recent student of the scroll’s colophons, judged the image essentially complete and explained the colophon characters touching the edges as the calligrapher’s own crowded layout[5]. Three aspects of the present evidence bear on this position. First, the truncation is not confined to the colophon: it is visible in at least nine independent motifs inside the painted image itself, where “calligraphic layout” cannot be the explanation. Second, the deficits are directional — they occur at the upper and lower edges, never at the leading or trailing ends of the roll, a pattern consistent with edge trimming rather than with localized damage or repainting. Third, the two most reliable upper-edge estimates (crane, signboard) and the two lower-edge estimates (man, horse) converge on ~ 9.5 mm, an internal consistency that would be unlikely if the truncations were accidental or painterly. We note, however, that Yu Hui’s analysis of the colophon sequence remains the standard account of the scroll’s textual history, and that our data bear only on the physical support; the two lines of evidence are complementary rather than mutually exclusive, and both are compatible with the scroll having been trimmed.

The bearing of these findings on the wider art-historical interpretation of the scroll is developed in Section 4.6.

4.3 Implications for conservation and digital heritage

If the original height of the support was approximately 278–280 mm, then the present 24.8 cm format is not the artist's format, and several consequences follow. First, conservation documentation should record the truncation evidence systematically — the indicators listed in Table 1 are all observable in the museum's own high-resolution imaging — so that any future remounting does not further reduce the support. Second, digital reconstruction of the original format (e.g. by inpainting the edge strips guided by the reconstructed motifs) becomes a well-posed task at the positions where the complete forms are inferable; the crane and the signboard provide the strictest guides. Third, art-historical readings of the composition as deliberately "cropped" or as abutting the frame should be treated with caution: the present edges are the product of conservation history, not of the painter. The super-resolution and spectral imaging work already published for this scroll[12] makes such a digital restoration feasible with existing data.

4.4 New observations and directions

Two observations that have not, to our knowledge, been reported before follow from this study. First, the crane-to-cross proportion of the huabiao devices (h/d = 1.66) is a stable in-painting metric that can serve as an internal scale for lost vertical material whenever a duplicate of a motif survives elsewhere in a composition. Second, the truncation indicators form a coherent, directional pattern — approximately 9.5 mm at the lower edge and at the most reliable upper-edge positions, with smaller and more scattered values elsewhere — which identifies edge trimming during remounting as the mechanism of loss rather than local damage. These observations open several concrete directions. Automated edge analysis over the full 5.3 m of the scroll would test whether the trim width varies along the roll, as the scatter of the smaller upper-edge values suggests (Fig. 6). Non-destructive examination of the support edges (e.g., under transmitted light or by spectral imaging) could confirm the physical boundary of the original paper beneath the mount. Digital restoration of the edge strips, guided by the reconstructed motifs, would provide a testable reconstruction of the original format against which compositional readings of the scroll — Hansen's three-part structure[1], the social readings of Itō and Yoshida[3], and the political readings of Tsao[2] — could be reassessed. Finally, systematic comparison of truncation indicators across the major later versions of the composition would clarify whether the vertical loss is peculiar to the Song original or a general feature of the scroll tradition.

4.5 Limitations

The principal limitations of this study are: (i) measurements were made by a single operator on digital images, with a practical precision of ± 0.5 mm; (ii) the ratio method rests on the assumption that the painter rendered the crane-to-cross proportion identically on both banks, an assumption supported by the intact south-bank pair but not directly verifiable for the lost north-bank upper part; (iii) the 6 mm composition margin is an assumption, and the upper-edge loss is therefore given as a range rather than a point; (iv) the estimates are necessarily lower bounds wherever a motif was already set below the trimmed edge; and (v) the historical records constrain but do not measure the original height. Multi-

observer measurement, denser sampling of the edges, and non-destructive physical inspection of the support edges (e.g. under transmitted light) would strengthen the estimates; automated edge analysis over the full 5.3 m of the scroll would test whether the trim width varies along the roll as our upper-edge scatter suggests.

4.6 Broader implications for the art-historical interpretation of QSHT

The evidence assembled in this study bears not only on the physical history of the scroll but also on the interpretive frameworks through which it has been read. A vertical format reduced by roughly 11–13% is not a neutral fact of conservation: it defines what generations of viewers, including modern scholars, have actually seen, and any reading of the painting that rests on the present edges is, strictly speaking, a reading of a cropped image. Three influential strands of English-language scholarship illustrate what is at stake, and each is affected in a different way.

Hansen's reading of the scroll as a deliberately structured composition in three sections, with the Hongqiao bridge as its midpoint1, operates in the horizontal dimension, and our data leave that tripartite division intact: the truncation indicators are distributed along both edges without disturbing the scroll's narrative thirds (Fig. 6). In this respect the three-part structure survives the correction of the vertical format. What the present findings affect is the evidentiary basis of two claims that accompany it. First, Hansen argues that the painting presents an idealized city, orderly and free of crime, dirt and danger; a substantial part of that impression of completeness is carried by precisely the elements that our measurements show to have been cut away, namely the cranes atop the huabiao, the chiwen of the city-gate tower, the ridge ornaments of temples and the upper characters of shop signs. On the reconstructed format these elements are present and legible, so the ideal-city reading would, if anything, be strengthened rather than weakened by the restoration of the original height. Second, Hansen treats the composition as deliberately structured; if the upper register once carried complete emblematic elements, those vertical markers belonged to the painter's intended design, and their absence from the present format should not be allowed to suggest that the scene was simpler than the artist planned. The three-part structure itself stands; the grounds on which it is argued should be updated to the restored format.

The social reading of Itō and Yoshida3, framed as the "light and shadow" of Northern Song society, draws on the painting's dense record of everyday life, from shopkeepers and porters to boatmen and the urban poor. Two qualifications follow from our measurements. On the one hand, the main body of that social record survives: the lower-edge loss of approximately 9.5 mm removes chiefly the lower legs of figures and the hooves of animals, and the street-level narrative of trade and labour remains essentially intact. On the other hand, the upper register, where the most reliable losses occur (crane, signboard), removed precisely the visual markers that carry the "light" side of the contrast, such as complete signboards, intact architectural crests and the full huabiao with its crane. A format that has lost these elements systematically understates the order and prosperity that the painting records while preserving

almost all of the evidence of labour and crowding; in other words, the present format may tilt the balance of the “light and shadow” reading towards shadow. Social-historical use of the scroll should therefore state explicitly that the evidence image is a cropped version of the artist’s composition and, where possible, test its claims against the reconstructed format.

Tsao’s political reading2 locates in the scroll a response to the tensions and compromises of Northern Song political life, a society urged towards solidarity in the face of impending crisis. The symbols on which such a reading depends are strikingly concentrated in the register that our measurements show to be missing: the huabiao, an emblem of imperial order, is truncated at both bridgeheads; the city-gate tower loses its chiwen; the temple loses its ridge ornament. These are exactly the elements that a political iconography would deploy. The present study does not confirm or refute Tsao’s interpretation, but it supplies something that the debate has so far lacked: quantitative evidence that these emblematic elements were present in the original composition and were removed by remounting rather than being absent from a painting that never had them. Read on the reconstructed format, the political symbolism of the upper register is restored, and the pictorial ground for a political reading is correspondingly fuller. Conversely, the fact that successive mounters chose to sacrifice precisely this upper register while preserving the length of the scroll is itself a datum for reception history: it suggests that the horizontal, narrative dimension of the scroll, the world of the market and the street, was valued above the vertical, emblematic dimension. That asymmetry of preservation deserves attention in any account of how the scroll has been understood across its later history.

Taken together, these three cases show why the loss of a few centimetres matters. In each reading, structural, social and political, the cropped edges were not neutral borders; they carried emblematic and narrative material that the readings either presuppose or ignore. The contribution of the present study to the technical-art-history and heritage-science agenda is to convert the vertical loss from a matter of conservation detail into a first-order datum for interpretation: the format in which a painting is seen is itself part of the evidence, and every reading of QSHT should be format-aware, anchored either to the present 248 mm format or, preferably, to the reconstructed 278–280 mm format. Digital restoration along the lines sketched in Section 4.3 offers a practical means of testing how the restored composition alters the balance of these readings.

5. Conclusions

Quantitative image-based dimensional analysis of the Palace Museum version of *Along the River During the Qingming Festival* indicates that at least nine independent motifs are truncated by the upper and lower edges of the painting paper. Reconstruction of the north-bank huabiao crane from the intact south-bank pair (h/d = 1.66) yields a deficit of 9.45 mm at that position, and the most reliable indicators converge on edge losses of approximately 9.5 mm, implying a total vertical loss of roughly 30–32 mm and an original height of approximately 278–280 mm against the present 248 mm. This estimate is consistent with Li Dongyang’s 1515 record that the painting was “less than one chi” high and with the inferred original height of Zhang Zhu’s 1186 colophon paper. The findings indicate that the scroll’s

vertical format has been reduced by remounting, have direct implications for conservation documentation and digital reconstruction, and should inform any art-historical argument that rests on the present cropped format.

Declarations

Disclosure

statement

Declarations

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Author Contribution

Yanhui Yang Renjiang Zhang Chunping Zhang wrote the main manuscript text ,Yanhui Yang prepared tables&figures and revised the manuscript; All authors reviewed the manuscript

Availability of data and materials

All measurements and reconstructed values used in this study are reported in the main text and tables. The high-resolution digital images of the painting analysed here are publicly available through the Palace Museum’s digital publication platform and in the dataset of Wang et al.12. The colophon texts are reproduced in ref. 5.

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Figures

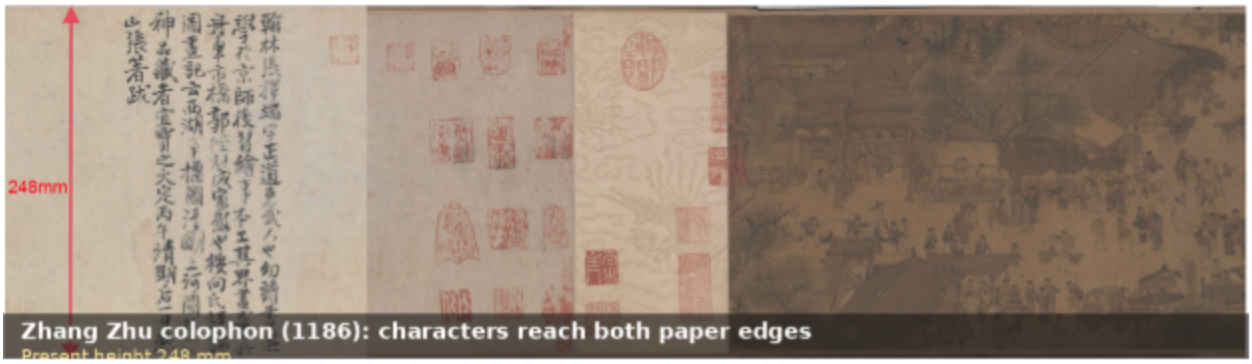


Figure 1

The Palace Museum version of QSHT in its present state, with Zhang Zhu's 1186 colophon at the tail. The characters of the colophon reach both the upper and lower edges of the paper; the 248 mm scale at the left marks the present height of the scroll. Source: detail of the Palace Museum's published digital reproduction of QSHT; the composite is limited by the resolution of the source plate (≈200 dpi at print width).

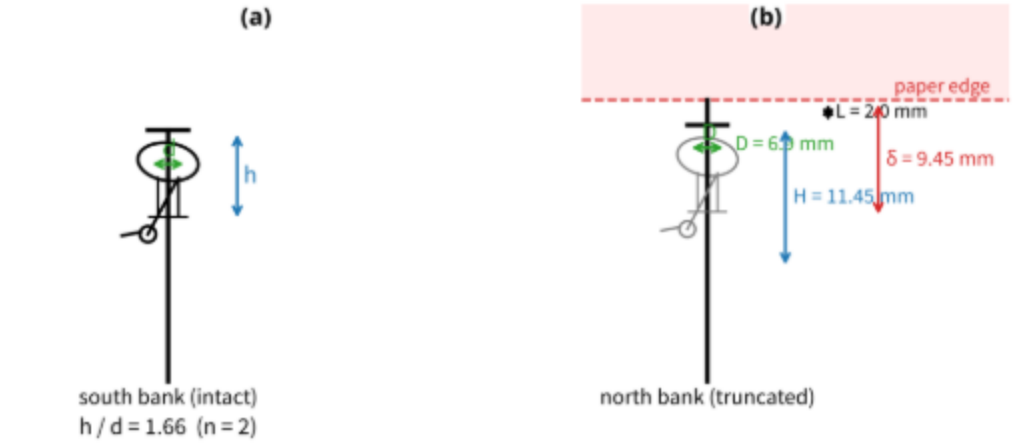


Figure 2

The huabiao-crane devices at the two bridgeheads of the Hongqiao bridge. (a) Intact south-bank huabiao crane, with the beak-to-cross proportion h/d = 1.66 used as the scale reference; (b) the truncated north-bank crane.



Figure 3

Reconstruction of the truncated north-bank crane and related truncation indicators. (a) The north-bank crane with measured cross-arm D = 6.9 mm, reconstructed beak height H = 11.45 mm, distance to the paper edge L = 2.0 mm, and deficit δ = 9.45 mm; the direct edge measurement gives 10.2 mm. (b) Signboard characters cut by the upper edge. (c) Temple chiwen (close view). (d) Wine-shop banner. (e) Temple ridge ornament (distant view). (f) Man whose lower body is cut. (g) Horse whose hind legs are cut. Source: details from the Palace Museum's digital reproduction of QSHT.

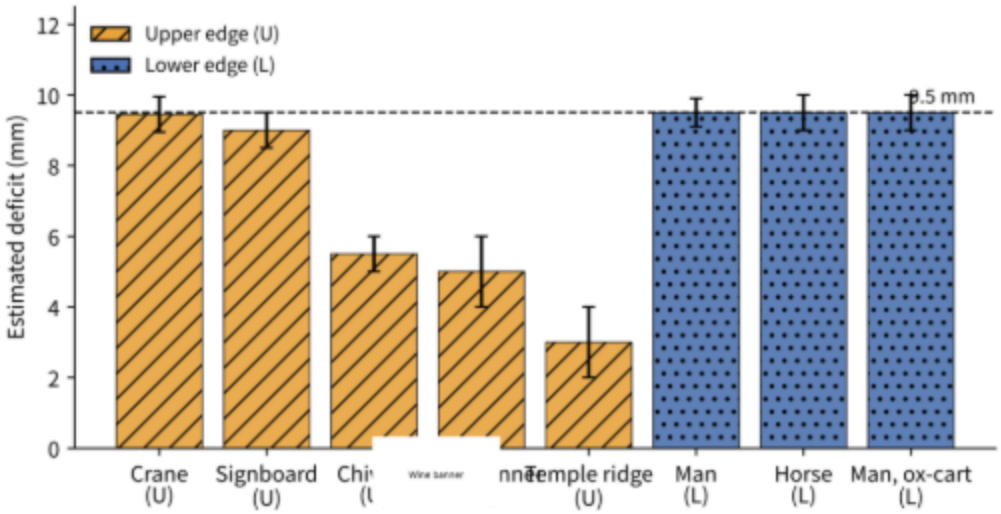


Figure 4

Estimated vertical deficits for the nine truncation indicators. Bars show the estimated deficit per indicator (U = upper edge, L = lower edge; hatching distinguishes the two edge groups independently of colour); the dashed line marks 9.5 mm. The four most reliable estimates (crane, signboard, man, horse) cluster at 9.0-10.2 mm. Source: measurements and reconstructions reported in this study (see Table 1 and Sections 2.2 and 4.1).

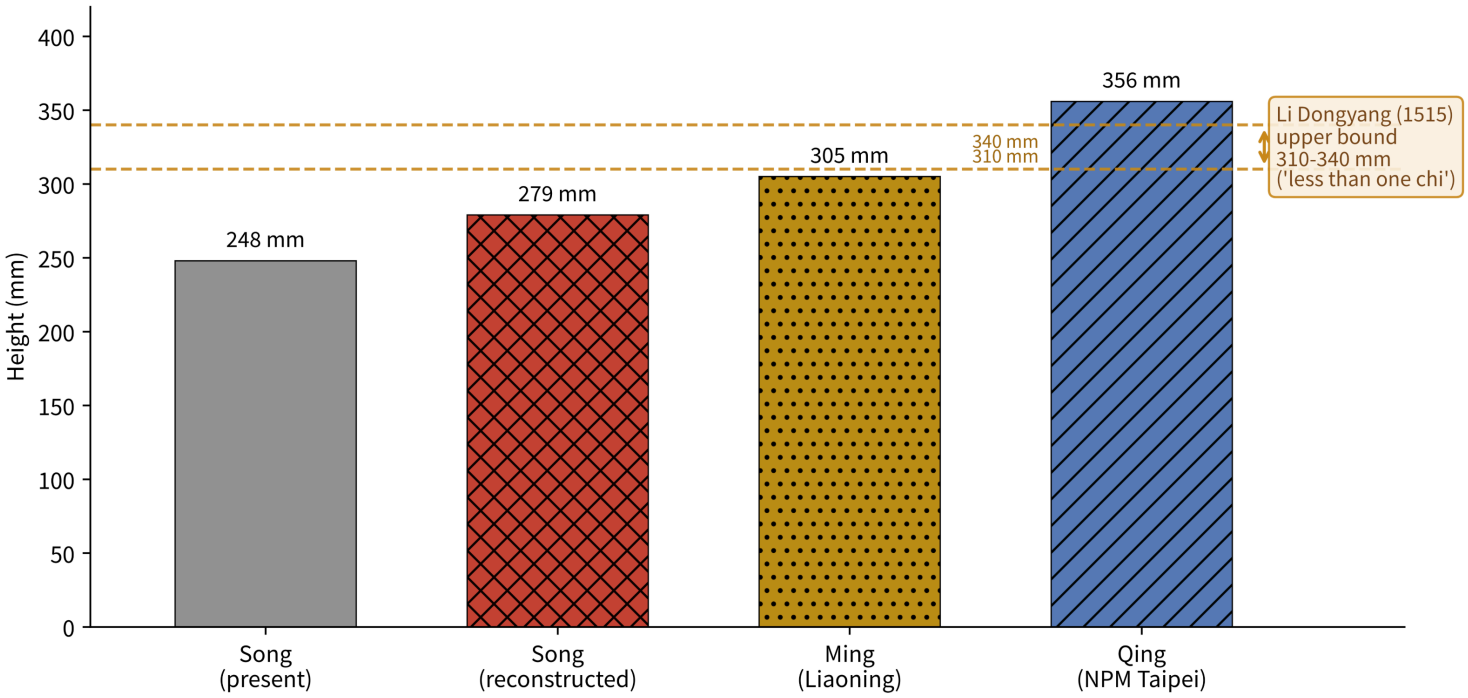


Figure 5

Vertical dimensions of the Song scroll and later versions. Present height (248 mm), reconstructed original height (278-280 mm), Li Dongyang's "less than one chi" upper bound (310-340 mm), and the heights of the Ming (305 mm) and Qing (356 mm) versions. Hatching distinguishes the versions independently of colour. Source: measurements in this study and museum collection records of the Ming and Qing versions (refs 19, 20; Table 2).

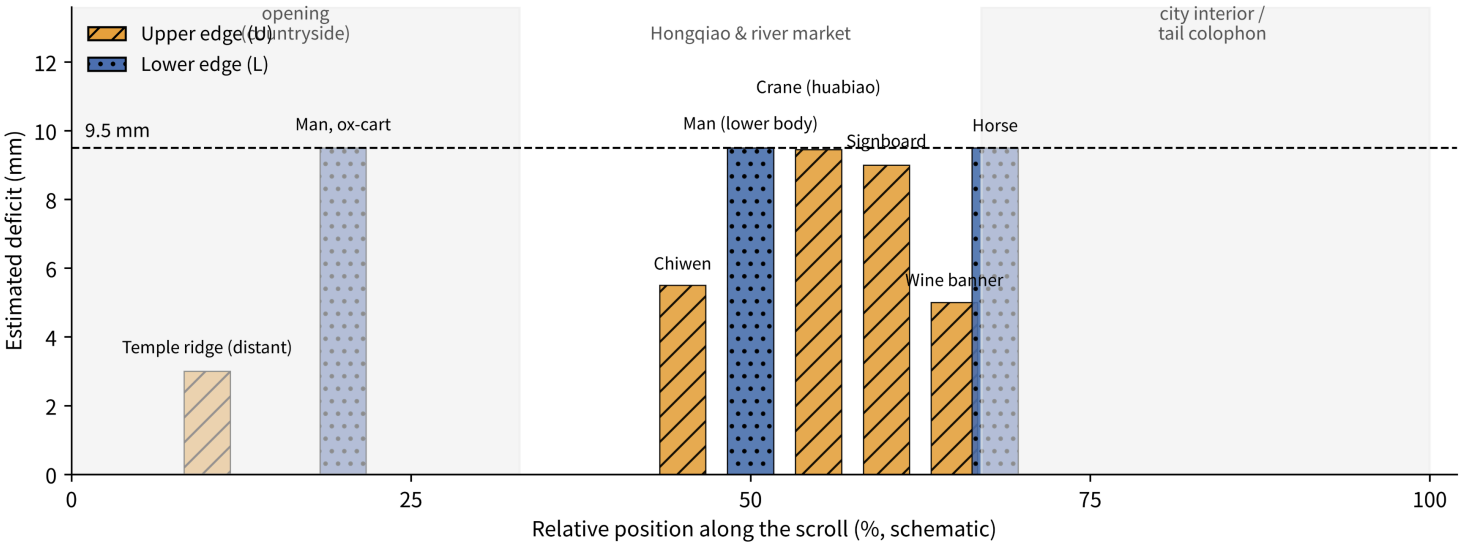


Figure 6

Distribution of the truncation indicators along the scroll. Bars show the estimated deficit at each indicator plotted against its relative position along the 5.3 m scroll (positions are schematic, keyed to the

scroll's narrative thirds: opening countryside, Hongqiao and the river market, city interior and tail colophon). Upper-edge (U) and lower-edge (L) indicators are distinguished by hatching; the dashed line marks 9.5 mm. The Zhang Zhu colophon indicator is qualitative and omitted from the plot. Source: measurements reported in this study (see Table 1).

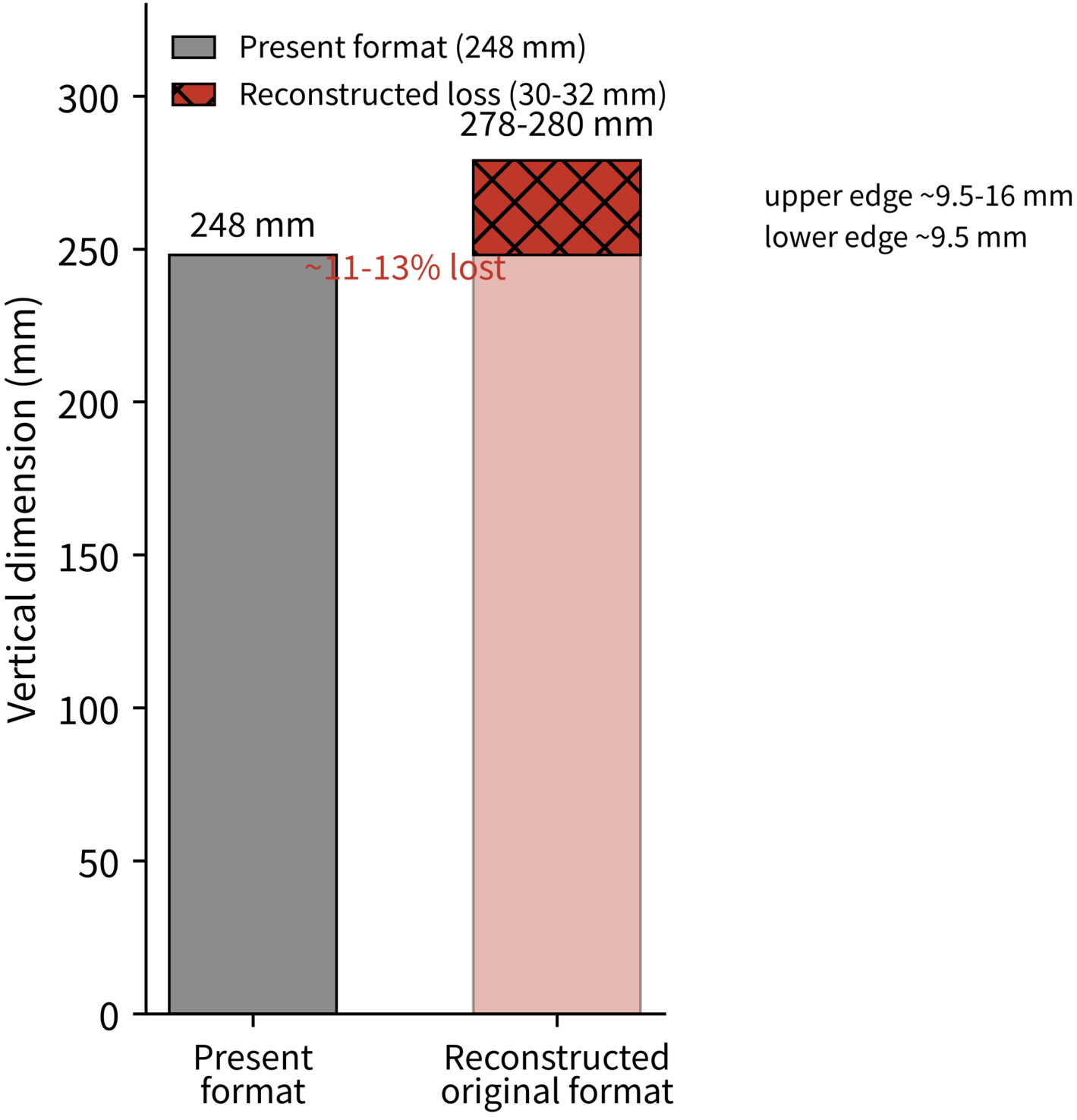


Figure 7

Present and reconstructed vertical formats of the Song scroll. The present support height (248 mm) is compared with the reconstructed original height (278-280 mm); the hatched strip represents the reconstructed total loss (30-32 mm, ~11-13% of the original height), with the lower-edge (~9.5 mm) and upper-edge (~9.5-16 mm) components annotated.

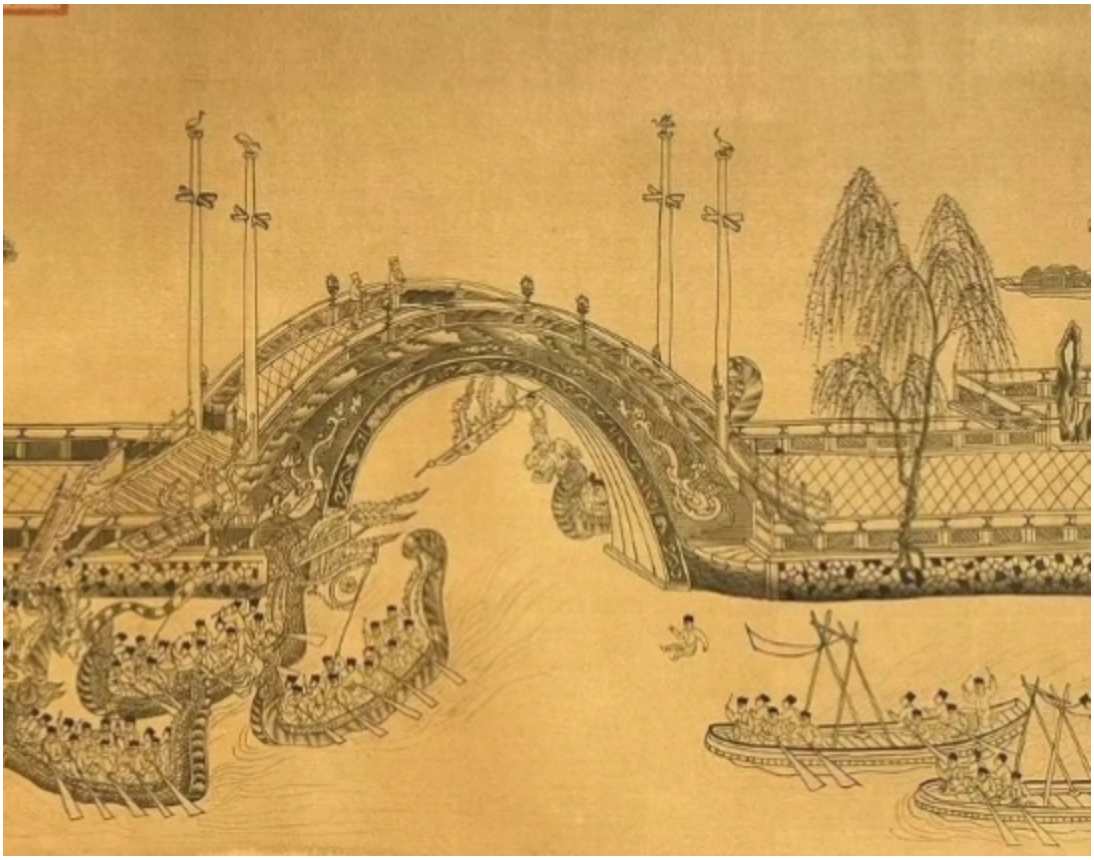


Figure 8

The crane in Wang Zhengpeng's "Longzhou Jingdu Tu". The Yuan-dynasty handscroll shows the same crane-perched-on-cross-arm motif as the QSHT huabiao devices, together with a colophon by Zhang Zhu; the beak-to-cross proportion of these cranes matches the h/d = 1.66 ratio measured on the intact south-bank huabiao of QSHT, supporting the use of this proportion as a painterly scale reference. Source: detail of Wang Zhengpeng's handscroll, Palace Museum, Beijing.

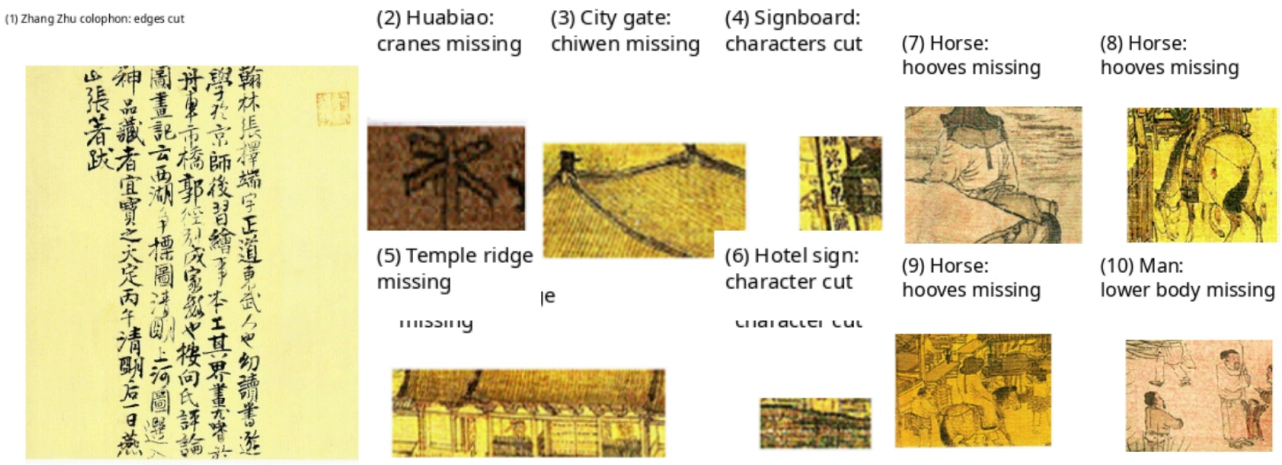


Figure 9

Visual summary of the truncation evidence in the Palace Museum version of QSHT:

(1) the absence of Zhang Zhu's colophon on the handscroll;

(2) the two cranes missing from the upper end of the huabiao on the north bank of Hongqiao bridge;

(3) the chiwen missing from the main ridge of the city gate tower;

(4) characters missing at the top of the erect signboard of the Wangjia Jinpu;

(5) the ridge ornament of the temple missing;

(6) a character missing from the upper part of a hotel sign;

(7) a horse on the south bank of the Bianhe missing its hind legs;

(8) a horse near the Jiaodian missing its hooves;

(9) a horse behind a bullock cart missing its hooves;

(10) a man near the "Jie" shop missing his lower body. Source: details from the Palace Museum's digital reproduction of QSHT.