

Han dynasty texts on the surveying of river dykes

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Twenty-three strips of wood and bamboo acquired by the Chinese University of Hong Kong and published in 2001 provide evidence for the existence of river dikes in Hubei during the Han period, and for the government's administration of them.¹ Apart from the original publication, which was not extensively annotated, the texts were studied in more depth by Peng Hao in 2005.² In this paper I will translate the texts and discuss the various issues they raise.

The university acquired a total of 259 slips, dating from the Warring States to the Eastern Jin. They are thus of various origins, and there is no good way to prove their authenticity or which strips belong together. Most of the slips are Western Han administrative documents dealing with such matters as fodder for livestock and the management of slaves. The unfortunate lack of provenance data makes it impossible to assume any relationship between the various types of texts, nor do the editors suggest any, so I will only discuss the strips on dikes. The 23 slips discussed in this paper are of different sizes and shapes, but all are clearly of the same origin, judging by their contents.

It is almost certain that the strips are the product of routine bureaucratic activity, probably a survey of dikes for the purpose of managing and maintaining them. The authors were also engaged in calculating the average width of these dikes, probably in order to facilitate future administration. However, the use to which that figure was to be put, is not clear. In fact, it is not clear why dikes would be measured in area at all, though it probably does provide a proxy for their size.

One aspect of these texts that is both amusing and telling is the large number of mathematical errors in the texts, which is probably evidence for the relatively weak mathematical skill of these surveyors. Although palaeographers have, of necessity, devoted considerable attention to the issue of literacy and scribal skills,

¹ Chen Songchang 陳松長, *Xianggang Zhongwen daxue wenwuguan cang jian du* 香港中文大學文物館藏簡牘 (Hong Kong: Hong Kong Chinese University Museum, 2001).

² Peng Hao 彭浩, “‘Hedi jian’ jiaodu” ‘河隄簡’ 校讀, *Kaogu* 2005.11: 71-75.

these are among the few texts that allow us to evaluate the level of numeracy among what were probably low-level bureaucrats.

Content

These texts are written on various sizes of bamboo and wooden strips, and can be divided into two types by content: summary strips, and measurement strips. The summary strips, which frequently begin with black dots, come in various sizes, and seem to record the total length of the dikes of the smaller political units listed on all of the measurement strips from the area. The measurement strips are wooden strips around an inch wide and under a foot long with two lines of text, the second of which begins with *lü* 率. These strips record the basic length and area information, compare these measurements with width-rates (廣率) and then record whether the area calculated with the width-rate is higher or lower than the original figure, along with the discrepancy. Although it seems clear that the figures on the summary strips represent the totals from the various areas described in the other strips, none of the sets are complete and so we cannot be certain.

The following explanations will be easier to understand if read alongside the texts themselves, below. The pattern for the measurement slips is: [higher level place name][lower level place name][dikes隄][altogether凡] [Length][Area][Width-rate][L x W][A-(L x W)]. The length and the area are the variables that are already known. The width-rate has already been calculated by dividing the area by the length and then rounding to the nearest fraction (either a whole number, a half, or one or two thirds). Thus the width-rate is simply a rounded average of the width, and the second part of the strip evaluates the difference between the area calculated using the width-rate and the actual area.

The pattern for the summary strips is [higher level place name][dikes隄][altogether凡] [Length][Area]. Strip 222³, the only one that discusses field areas and land reclamation, is clearly of this type.

The purpose of the measurement slips, apart from recording the length and area, is to evaluate the width-rate *lü* 率 in relation to the actual area, presumably to establish a

³ I will use the numbers from the original publication.

rate of measurement that will save surveyors from actually having to calculate the area manually in the future. This standard rate of measurement may represent the average width of the dike itself, or possibly the road on top. It is possible, but unlikely, that it represents a measurement of some other kind of embankment with agricultural application.

Mathematical issues

In the Han, 1 *bu* 步=1.38m and 1 *li* 里=415m.⁴ In both the Mt. Zhangjia mathematical texts and the *Jiuzhang suanshu*, 1 *li* = 300 *bu*, 1 *qing* 頃 = 100 *mu* 畝 and 1 *mu* = 240 *bu*.⁵ So a *mu* is 457.056m² and a *qing* is 45,705.6m². An acre, by comparison, is 4,047m² and a hectare is 10,000m². The phrases 大半步 and 少半步 mean 2/3 and 1/3, respectively.

The phrase “畸 (多 or 少) 實 number 步” refers to the difference between the actual area and that measured with the width-rate. Chen Songchang and Peng Hao both read *ji* 畸 as *ji* 奇; but since the former is defined as “odd pieces of land that would not fit into the square system of dividing the land” and “surplus..fractional remainders,”⁶ there seems no reason to read it as 奇, which simply means (fractional) surplus. In this case it refers to a figure that can be positive or negative, and is thus best translated as “discrepancy.”

In mathematical terminology, *shi* 實 usually signifies the dividend in an equation, the original number that is to be divided. This technical meaning comes from its original meaning of “full, solid.”⁷ In this case the *shi* functions as the dividend when it is divided by the length in order to calculate the width-ratio, a calculation that must have happened, but is not mentioned. The *shi* here refers to

⁴ Denis Twitchett & Michael Loewe, ed., *The Cambridge History of China vol. 1: The Ch'in and Han Empires 221 BC- AD 220* (Cambridge: Cambridge University Press, 1986), xxxviii.

⁵ Christopher Cullen, *The Suan shu shu 算數書 'Writings on reckoning': A translation of a Chinese mathematical collection of the second century BC, with explanatory commentary* (Cambridge: Needham Research Institute, 2004), 28. Published online at: www.nri.org.uk/suanshushu.html; *Jiuzhang suanshu* 九章算術, (*Congshu jicheng chubian* 叢書集成初編ed.) (Beijing: Zhonghua, 1985), 1.

⁶ R.H. Mathews, *Mathews' Chinese-English Dictionary Revised American edition*, Cambridge, Mass: Harvard University Press, 1975, 56; *Hanyu da cidian* 漢語大詞典 (Shanghai: Hanyu da cidian, 2000), 7.1392.

⁷ Cullen, *The Suan shu shu*, 27.

the actual area of land. The length is multiplied by the given width-rate, and the result is subtracted from the *shi* in order to achieve the difference (if any) between the two. Chen originally punctuated the text with a comma before the *shi*, implying that he read it as something like “remainder.” Thus the phrase “奇少,實十步” would mean “the surplus is negative, the remainder is 10 *bu*.” However, as Peng noted, this is incorrect.⁸ If we eliminate the comma then “畸少實十步” means “the discrepancy is fewer than the actual size by 10 *bu*”, which seems more likely. If this is correct it might also explain why the *ji* or *shi* are sometimes omitted. It can perhaps be considered a scribal error, but I believe the phrase means the same thing if either *ji* or *shi* is omitted. Therefore, unlike Chen and Peng, I have not added them in the transcription. If we read the *duo* or *shao* as a verb, i.e., “the discrepancy reduces the dividend by 10,” which means the same thing, it would be necessary to add the missing graph.

The graph 衛, read as *lǜ* 率, signifies some kind of standard rate of measurement, which is its normal meaning in early mathematical texts. The term appears in the Mt. Zhangjia mathematical texts and in the *Jiuzhang suanshu* 九章算術, both Han texts. Equations based on *lǜ* 率 were important in early mathematics because they dealt with calculating exchange value without fractions because coins were the lowest form of currency and could not be divided. Thus instead of treating the coin as the standard, one had to be able to measure one object using the other as the unit of value, as expressed in the common phrase “以 (specific unit of measure)率之. The second *juan* of the *Jiuzhang suanshu*, which is concerned with converting between grain prices, begins with a list of grain price rates, followed by the rule of conversion between them. Liu Hui’s (263 AD) commentary reads:

“That which will be used as a rate must be equated with a unit. According to [the exchange rules] millet's rate is 5 and hulled millet's rate is 3. This is millet 5 per unit, hulled millet 3 per unit. To exchange millet for hulled millet, first regard millet as the unit. [One] unit is to be divided by 5. That is 5 as unit. Multiply it by 3, that is [one] unit as 3. Hence the rates for [one] unit are equivalent, that is 5 to 3.”⁹

⁸ Peng Hao, “‘Hedi jian’ jiaodu,” n. 3.

⁹ I.e, if $5\text{粟} = 3\text{米}$, how do we calculate 1 粟 in terms of 米? $1 \div 5 \times 3 = 3/5$. $1\text{粟} = 3/5\text{米}$. This translation is based on that found in Shen Kangsheng et al. *The Nine Chapters on the Mathematical Art: Companion and Commentary*, Oxford : Oxford University Press, 1999, 142, but I have modified the

“為率者必等之與一。據粟率五、糲率三，是粟五而為一，糲米三而為一也。欲化粟為米者，粟當先本是一。一者，謂以五約之，令五而為一也。訖，乃以三乘之，令一而為三。如是，則率至於與一，以五為三矣。”¹⁰

This shows that *lǜ* rate is used to establish one type of material or measurement as the unit of calculation.

The phrase 不衡 (率) appears at the end of strips whose difference from the actual size is -490, -150 and -810 bu^2 while it does not appear at the end of strips which differ by 50, 135, 160, 250, 700, -1,192 and $62 \frac{2}{3} bu^2$. Thus it might seem that *bu lǜ* is usually used when the discrepancy is negative, especially since strip 209, which is where the -1,192 comes from, has multiple errors. However, Peng cites a passage from the Mt. Zhangjia *Zouyanshu* 奏讞書 which suggests that it simply means not equal to the rate: 行道六十日，...行5146里。率之，行日85里，畸46里不率 If someone travels 60 days, and covers 5146 *li* we can take 85 days as the rate, with a remainder of 46 *li* ($5146 = (60 \times 85li) + 46$)¹¹ Thus it is probably simply a more verbose way of describing a discrepancy.

One of the most interesting aspects of these texts is the large number of mathematical errors. The initial calculation of the width-rate, while not always perfect, is usually pretty accurate. However the calculations represented by these strips are often incorrect. Of eleven intact strips which calculate width-ratio, seven have errors of multiplication. Most of these errors can be traced to the accidental use of the wrong figure in multiplication, which is probably due to incompetence in the use of counting rods. The counting rod system, while capable of doing complex mathematics when used by a professional, was nonetheless far more difficult than an abacus, and therefore it is quite possible that a poorly trained official, or assistant, was simply not very good at using them. But it also seems probably that none of the errors was off by such a significant degree as to make the results unusable.

Location

The texts are clearly administrative texts used for keeping track of the sizes of river dikes and, in one case, for recording the amount of arable land that can be

translation to read more literally.

¹⁰ *Jiuzhang suanshu* 九章算術, 24.

¹¹ Peng “‘Hedi jian’ jiaodu,” 73.

reclaimed. I assume that these dikes are long dikes along rivers, used to protect from seasonal inundations, not polders or collections of small dikes, and that the area discussed on strip 222 is land made arable by the construction of dikes. It is quite possible that the measurements discussed on each text could represent the length of all the river dikes from the specified administrative unit; I translate dike in the plural only because English does not allow the numerical ambiguity of Chinese.

It is also worth noting that these embankments may represent something completely different from a dike to protect from flood water. It does seem strange to first measure the exact area of a dike and then calculate its average width, when it would seem that one could have done that without bothering to first calculate the area. But the phrases *he di* 河隄 and 江隄 are not likely to refer to anything other than river dikes, and if Peng is right that the location is in Hubei than this is not surprising.

Peng begins his discussion of location by mentioning that Yicheng 宜成(城) is the name of a place in Shandong known from the *Han shu*, but argues against this being the same place because there is nowhere in Shandong with so many river dikes.¹² However, Yicheng was located directly beside what was then the Ji 濟 river, and therefore was exactly the place one might expect there to be river dikes, and we know that the state of Qi did build dikes to protect itself from flooding.¹³ But according to the *Zhongguo lishi dituji* there was an Yicheng located on the Han river about 100km north of modern Jingmen city, Hubei.¹⁴

Peng argues that the Jingling 竟陵 mentioned in strip 214 refers to a county of the same name mentioned in the *Han shu* as being on the banks of the Han river. However, only the bottom half of the graph is visible, and Chen had originally not transcribed it. It may well be *jing*, but it may not. Jingling is located about 150km due west of Wuhan on the Han river.

Peng does not mention the 醴陽 located to the southeast of Changsha (in a flat

¹² Peng “‘Hedi jian’ jiaodu,” 74.

¹³ Yang Kuan 楊寬, “Zhanguo shidai shuili gongcheng de chengjiu” 戰國時代水利工程的成就 in *Zhongguo kexue jishu faming he kexue jishu renwu lunji* 中國科學技術發明和科學技術人物論集, ed. Li Guangbi 李光璧 & Qian Junye 錢君曄 (Beijing: Sanlian, 1955), 103-5.

¹⁴ Tan Qixiang 譚其驤, ed., *Zhongguo lishi dituji* 中國歷史地圖集 (Beijing: Zhongguo ditu, 1982) vol. 3, 22.

river valley well-suited to river dikes, it must be noted) according to the *Zhongguo lishi dituji*, but rather suggests a location on the Li 澧 river which flows just south of the Yangzi river in the same region.¹⁵

Ruo Xiang 若鄉 would appear to be associated with 都鄉/若縣 located beside the Han river 10km from Yicheng. However, Peng notes that the Mt. Zhangjia *Ernian lüling* 二年律令 and the *Han shu dilizhi* both include lists of the counties included in *Nan jun* 南郡 and both of these include Jingling, Liyang and Yicheng. Neither includes a Ruo xian. Because the *Ernian lüling* is an early Han text, Peng concludes that the absence of Ruo xian shows that this text was produced before Ruo xiang had been upgraded to Ruo xian, and thus it must be an early Han text.¹⁶ The problem is the earliest evidence he presents for Ruo xiang becoming a xian is the *Shuijing zhu*. Moreover, it seems that the three other place names were all in use into the Eastern Han. Thus I don't see any reason to date these texts specifically to the early Western Han.

Peng considers these texts evidence of the development of new agricultural land, and strip 222 is clear evidence of this. However, there were dikes in the region centuries before the Han, so it cannot be assumed that these dykes were new. We know from the *Zuo zhuan* that there were dykes in Chu much earlier. In 548 B.C. Wei Yan 蔦掩 was appointed minister of war in Chu, and immediately calculated the entire resources of the state:

Wei Yan recorded the ground and fields, measured the forests in the mountains, added up the wetlands and marshes, distinguished hills from tombs, noted barren and saline ground, calculated border wetlands, regulated embankments, put livestock to graze in marshy places, divided fertile land into grids, and adjusted the *fu* tax based on the income of each area 蔦掩書土田，度山林，鳩藪澤，辨京陵，表淳鹵，數疆潦，規偃豬(潒)，町原防，牧隰皋，井衍沃。量入修賦。¹⁷

This passage shows not only that there were dikes (偃豬) in place in the Spring and Autumn period, but also that the Chu government was measuring and recording

¹⁵ Tan Qixiang, ed., *Zhongguo lishi dituji*, vol. 3, 22.

¹⁶ Peng “‘Hedi jian’ jiaodu,” 74.

¹⁷ *Zuo zhuan* (Duke Xiang year 25); Ruan Yuan 阮元, *Shisanjing zhushu: fu jiao kanji* 十三經注疏：附校勘記 (Beijing: Zhonghua, 1980), 1985-6

them. Thus these texts must be understood as continuing a practice that was not at all new in the Han, but for which we have lacked direct evidence.

Although they are few, and their content is relatively simple, these texts provide a glimpse into the world of surveyors in Hubei during the Han period. They are also important sources on early numeracy and practical mathematics. And they are rare primary sources on the conversion of wetlands into farm land and of the government's role in this process.

Text and translation

200

南鄉南均隄凡十八里百七十步，積五萬五千六百五十步。
率廣十步，積五萬五千七百步，畸多實五十。

The South Village South Gou dikes are altogether 18 *li* 170 *bu* (5,570 *bu*/7,704.6m); their area is 55,650 *bu*² (106,000m²). Calculating at the rate of 10 *bu* wide, the total area is 55,700 *bu*², and the discrepancy exceeds the actual area by 50 *bu*².

201

南鄉宜禾隄凡十三里百卅步，積二萬五千九百八十步。
率廣六步，少半步，積二萬五千四百九十步，畸少實四百九十步，不率。

The South Village, Yihe dikes are altogether 13 *li* 130 *bu* (4030 *bu*/5,574.4m); their area is 25,980 *bu*² (49,500m²)¹⁸. Calculating at the rate 6 1/3 *bu* wide, the area is 25,490 *bu*², and the discrepancy is lower than the actual area by a 490 *bu*² difference from the rate.

202

南鄉耆靡隄凡十里廿步，積四萬三千八百步。
(率)廣十四步半步，積四萬三千九百卅五步，多實百卅五步。

The South Village ? Mo dikes are altogether 10 *li* 20 *bu* (3020 *bu*/4177.6m); their area is 43,800 *bu*² (83,400m²). Calculating at the rate 14.5 *bu* wide, the area is 43,935 *bu*², which exceeds the real area by 135 *bu*².¹⁹

203²⁰

•莫陽鄉河隄凡卅里二百卅六步。積四萬五...

¹⁸ As Peng notes, 4030 *bu* x 6 1/3 = 25,523 *bu*, not 25,980. It is possible that the original calculation to determine the width-rate was done with a "correct" figure close to 25,523, and then the subtraction which determined the difference between "real" figure and width-rate was done with the current, incorrect figure (25,980). If so, the difference should be +33, not -490.

¹⁹ 3020 x 6 1/3 = 43,790, not 43,935. Probably they miscalculated by accidentally using 3030 (43,935 = 3030 x 14.5) instead of 3020.

²⁰ The black dots represent black dots on the strips themselves.

The Moyang Xiang river dikes are altogether 30 *li* 246 *bu* (9246 *bu*/12,790m); their area is 45,000 (or 40,500, etc.)...

204

莫陽鄉桃丘隄凡十二里八十步，積二萬二千九百廿步。

率廣六步，積二萬二千八十步，畸多實百六十步。

The Moyang Village Taoqiu dikes are altogether 12 *li* 80 *bu* (3680 *bu*/5090.4m); their area is 22,920 *bu*² (43,600m²). Calculating at the rate 6 *bu* wide, the area is 22,080 *bu*², and the discrepancy exceeds the true size by 160 *bu*².²¹

205

莫陽鄉徹丘隄凡八里百廿步，積七千五百六十步。

率廣三步，積七千五百六十步。

The Moyang Village Cheqiu dikes are altogether 8 *li* 120 *bu* (2520 *bu* /3485.6m); their area is 7,560 *bu*² (14,400m²). At the rate of 3 *bu* wide, the area is 7,560 *bu*².

206

口陽鄉隄凡卅六里，積八萬二千五百五十步。

率廣六步，積八萬二千八百步，畸多二百五十步。

The ? yang Village dikes are altogether 46 *li* (13,800 *bu*/19,090m); their area is 82,550 *bu*² (157,200m²). At the rate of 6 *bu* wide, the area is 82,800 *bu*², and the discrepancy exceeds the actual area by 250 *bu*².

207

•北鄉河隄凡七十二里七十步，積廿萬七千卅步。

The North Village river dikes are altogether 72 *li* 70 *bu* (21,670 *bu*/29,977m); their area is 27,030 *bu*² (51,475m²).

208

北鄉京（橐？）口隄凡卅二里六十步，積七萬九千八百步。

率廣八步少半步，積八萬五百步，多實七百步。

The North Village ? dikes are altogether 32 *li* 60 *bu* (9660 *bu*/13,362.8m); their area is 79,800 *bu*² (153,400m²). Calculating at the rate of 8 ½ *bu* wide, the total area is 80,500 *bu*², which exceeds the actual area by 700 *bu*².

209

北鄉橐中隄凡卅里百六十步，積八萬五百八十步。

率廣八步大半步，積七萬九千三百八十六步大半步，少實千一百九十二步。

The North Village Tuozhong dikes are altogether 30 *li* 60 *bu* (9060 *bu*/12,532.8m); their area is 80,580 *bu*² (153,300m²). Calculating at the rate of 8 ⅔ *bu* wide, the total

²¹ This is an error: either the final number should be -840 or one of the other numbers is miswritten. Because the difference between correct discrepancy and the one written is exactly 1000, we can guess that the original area was probably 21,920, then the scribe wrote 2 in place of 1, in which case the discrepancy would be 160, as written.

area is $79,386 \frac{2}{3} bu^2$, and the discrepancy is lower than the actual area by $1,192 bu^2$.²²

210

•若鄉河隄凡廿七里百六十步，積六萬四千五百卅五步。

The Ruo Village river dikes are altogether $27 li 160 bu$ ($8260 bu/11,425.8m$); their area is $64,545 bu^2$ ($122,900m^2$).

211

若鄉口北隄凡九里百五十二步，積萬八千步。

率廣六步少半步，積萬八千六十二步大半步，畸多實六十二步大半步。

The Ruo Village ? north dikes are altogether $9 li 52 bu$ ($2752 bu/3806.8m$); their area is $18,000 bu^2$ ($34,300m^2$). At the rate of $6 \frac{1}{3} bu$ wide, the area is $18,062 \frac{2}{3} bu^2$, and the discrepancy exceeds the actual area by $62 \frac{2}{3} bu^2$.²³

212

口鄉嬰隄凡廿二里一百五十步，積四萬八千一百步。

率廣七步少半步，積四萬七千九百五十步，畸少實百五十步，不率。

The ? Village Ying dikes are altogether $22 li 150 bu$ ($6750 bu/9337m$); their area is $48,100 bu^2$ ($91,600m^2$). At the rate of $7 \frac{1}{3} bu$ wide, the area is $47,950 bu^2$, and the discrepancy is lower than the actual area by a $150 bu^2$ difference from the rate.²⁴

213

口鄉厭兼隄，凡十五里卅步，積三萬一千一十步。

(率)廣六步大半步，積三萬二百步大半步，畸少實八百一十步，不率。

The ? Village Yanjian dikes are altogether $15 li 30 bu$ ($4530 bu/6266.4m$); their area is $31,010 bu^2$ ($59,100m^2$). At the rate of $6 \frac{2}{3} bu$ wide, the area is $30,200 bu^2$, and the discrepancy is below the actual area by a $810 bu^2$ difference from the rate.

214

竟陵河隄口口百口八里不。。。

The Jingling river dikes...8 li...

215

...里百二十步...積...百口步...步,五百五十四步。

...li 120 bu...area...554 bu².

²² There are two errors here. First, $9060 \times 8 \frac{2}{3}$ is $78,520$, not $79,386 \frac{2}{3}$. If we divide $79,386 \frac{2}{3}$ by $8 \frac{2}{3}$ we get 9160 , which was probably the original length, miscopied as 9060 . If this was the case there would have been no discrepancy. The final error ($80,580 - 79,386 \frac{2}{3} = 1193 \frac{1}{3}$, not $1,192$) is not so easy to explain.

²³ There is an error here. $2752 \times 6 \frac{1}{3} = 17429 \frac{1}{3}$, not $18,062 \frac{2}{3}$. As with many of the others, this error can be explained by a single digit error. If the original figure had been 2852 and the 8 miswritten as a 7 , that would explain the error, and there would be no discrepancy.

²⁴ As Peng points out, $7 \frac{1}{3} \times 6750 bu = 49,500 bu$ rather than the stated $48,100$. It is unclear how this error was made.

216

...(廿?)八萬六千四步。²⁵

86,004 *bu*².

217

...萬六千六百□□步...

...五十步，多實三百步。

...(?)multiple of) ten thousand, six thousand, six hundred...*bu*...50 *bu*², over the actual area by 300 *bu*².

218

...千九百五十步□實四千五十四步，不率。

...?,950 *bu*². (Over/under) the actual measurement by 4,054 *bu*² different from the real rate.

219

...步，積...百五十六□卅八萬一千...

...*bu*. Area...?56 381,000...

220

...六千九百...

...6,900...

221

宜成河隄凡三百二十三里廿六步，積七十一萬九千六百一十八(步)。

The Yicheng River dikes are altogether 323 *li* 26 *bu* (96,926 *bu*/134,081m); their area is 719,618 (*bu*²) (1,370,400m²).

222

Front

宜成隄凡三百廿三里廿六步，積七十一萬九千六百一十 [八步]

●凡隄能治者九百廿一里二百卅步，積三百一十八萬一千八百一十二步，□ (為?) 田一□ (百?) (卅)

二頃五十七每 (畝) 百九十二步²⁶ ●醴陽江隄卅九里二十□步²⁷。

●凡隄不能治者三百廿一里二百二十七步 ●大凡千二百八十三里八十九步。

²⁵ Chen reads a *nian* 廿 reads while Peng does not. The published picture is illegible.

²⁶ Chen does not have the “為” or the “百卅” both of which were added by Peng. The “為” and “百” are possible, though unclear, while there is clearly no “卅”. Peng seems to have calculated it (correctly) from the previous figure. He also argues that the following 9, clearly visible on the strip, is an error that should be a 3, for 132 *bu* instead of 192 *bu*. However, neither figure matches exactly with the preceding figure (132 *qing* 57 *mu* 192 *bu*) according to the rates (1 *qing* 頃 = 100 *mu* 畝 and 1 *mu* = 240 *bu*) given above, whether we agree with Peng’s addition of a “卅”, for 132 *qing*, or not, in which case it is 102 *qing*.

²⁷ Peng has “卅九里二百廿二步”, which he derived by subtracting the other subtotals from the grand total.

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實三百一十八（萬）方²⁸一千八百七十二步

•三百人分之，人得卅四每（畝）卅六步，有（又）三百分步七十二。□□〔醴陽〕隄三十九里二百廿二步。

The Yicheng dikes are altogether 323 *li* 26 *bu* (96,926 *bu*/134,081m); their area is 719,61 (8 *bu*²) (1,370,400 m²). •Altogether the dikes that can be managed equal 921 *li* 240 *bu* (276,540 *bu*/382,546m). Their area is 3,181,812 *bu*² (6,059,500m²). This can make 132 *qing* 57 *mu* 192 *bu* of fields (3,181,872 *bu*²).²⁹

The Liyang river dikes are 39 *li* 222 *bu* (11,922 *bu*/16,491m). Altogether the area of dikes that cannot be managed is 321 *li* 227 *bu* (96,522 *bu*/134,081m). The overall length is 1,283 *li* 19 *bu* (384,919 *bu*/532,471m).³⁰

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The actual area is 3,181,812 *bu*². If 300 people divide it, each will get 44 *mu*, 46 *bu* and 72/300ths of a *bu*². The Liyang dike is 39 *li* 222 *bu*.

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□□□隄凡三百八十里，其□□里，不能治百□三里□□□□□千□百□□□積八十二萬一千七百步。

...dikes are altogether 380 *li* (114,000*bu*/157,700m), their...*li*, that which can't be controlled is one hundred...three *li*...821,700 *bu*² (1,564,000m²).

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²⁸ The strip is broken at this point, but there must be a *wan*. Both editors consider 'fang' a scribal error, but it could be a different form of the "wan" graph.

²⁹ Note the error of 60 *bu*.

³⁰ The total length of the Yicheng dike, the "dikes that can be controlled" and the Liyang dike (323 *li* 26 *bu* + 921 *li* 240 *bu* + 39 *li* 222 *bu* = 1,284 *li* 188 *bu* (389,957 *bu*)) is 5038 *bu* higher than the stated total of 1,283 *li* 19 *bu* (384,919 *bu*/532,471m), which is very close. However, one would expect the "dikes that can be controlled" to be an entirely separate category, so it may be a coincidence.

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