

OT Measurements in Translation

A Guide on some Basics and on some Special Issues

Peter Schmidt, 2025

“You shall do no wrong in judgment, in measures of length or weight or quantity.”

Lev. 19:35 (ESVUS16)

“Make things as simple as possible, but not simpler.”

Introduction

For details on biblical measurements, I would like to refer the reader to my earlier paper.¹ The main interest there was to determine the values. What I want to do here is to give a few more practical hints about dealing with measurements. I claim neither that this is a comprehensive guide, nor that the approach taken here is the only right one.

This guide is written mainly for translation teams who want to convert the OT measurements into modern ones, using metric units (meter, liter and kilogram). This raises some practical problems. Apart from reviewing some basic **principles** regarding measurements of length, capacity and weight, I address problems that come with **rounding** converted values up or down, and with the matter of **turning units of capacity into units of weight**, and some **further issues**. I comment on a few **complex passages**.

Anticipating these issues should help a translation team with a systematic approach, and reduce the number of “text repairs” in later stages of a project.

Thankfully, Norman Simón Rodríguez has provided an *Ancient Unit Converter*, which allows you to convert ancient biblical units to their modern equivalents with ease. The tool can be found under <https://normansimonr.github.io/ancient-unit-converter/>.

A translation team should explain their approach to measurements in their Introduction to the Bible.

Consistency versus Rounding

Consistency: Not surprisingly, some amounts occur repeatedly. For example, “100 talents” is found in three different contexts in 2Chronicles (25:6, 9; 27:5; 36:3), and once the multiple “600 talents” (3:8). It is desirable to keep them the same, or matching.

Rounding: Rounding off uneven figures will often be desirable, because it is better to communicate a meaningful amount than to side-track the reader with precise decimals. Obviously, in rounding, the larger the amount, the greater the deviation. Take, for instance, Neh. 3:13, which mentions

“1,000 cubits of the wall to the Dung Gate”.

When one calculates with 0.5 meters per cubit (see below), this becomes 500 meters instead of 444 meters, as it would be in a more accurate calculation.

If rounding is mentioned in the explanation about measurements in the Introduction to the Bible, the translator does not have to justify every single choice. Nevertheless, there could be cases where adding “about / circa / approximately” to the value is appropriate.

¹ *Biblical Measures and their Translation: Notes on Translating Biblical Units of Length, Area, Capacity, Weight, Money and Time*. Electronic Working Papers 2014-003. SIL International, 2014. <https://www.sil.org/resources/publications/entry/56085>.

Conflict of principles: When converting measurements, we will sometimes be caught in a dilemma: We have to decide between **keeping consistent with regard to other texts, or using numbers that are apt in the given story**. The problem is illustrated by this case:

In 1Sam. 17:7, we read about Goliath (based on NASB):

The shaft of his spear was like a weaver's beam, and the head of his spear weighed 600 shekels of iron.

Converting 600 *shekels* into kilograms results in 7.2 kg. Because the author's remark is not about mathematical precision, but about the daunting impression that this fighter's weapon made, we may round this down to 7 kg.

Now we turn to 1Ki. 10:29, where we find the same amount – 600 *shekels*, but in a combination. The verse says (based on NASB):

A chariot was imported from Egypt for 600 shekels of silver, and a horse for 150.

Converting 600 *shekels* and 150 *shekels* results in 7.2 kg and 1.8 kg. A translator might decide to round these figures up to 8 kg and 2 kg, in order to arrive at simple numbers, and also to make the ratio of 4:1 transparent. That is justified, but we lose some consistency with the method applied in 1Sam. 17:7, where we ended up with 7 kg, not 8 kg. Thus, we have to decide in each case which of the two principles is more important.

Another example for the conflict between round numbers and the proper ratio (proportion) is 1Chr. 29:4. It speaks of the material that David provided for the Temple and tells us of “3,000 talents of gold” and “7,000 talents of silver”. Going by a talent of 35 kg (see below), this turns into 105 tons : 245 tons. As soon as the 105 are rounded off too 100 tons (and perhaps the 245 to 240 or 250), the ratio of 3 : 7 between the two amounts gets distorted. This is not a grave problem, but something to be aware of.²

Length: the cubit (אמה *ammah*)

The basic unit for measuring length is the cubit. It occurs 251 times. The vast majority of occurrences relate to the Tabernacle or to Solomon's Temple and its objects, or to Ezekiel's vision of the new Temple. We find them in Exod. 25–38, 1Ki. 6–7 par. 2Chr. 3–4, and Ezek. 40–43. Other mentions of *ammah* are few and far between.

A cubit is equivalent to 44.4 cm. When a language does not have a word for ‘cubit’, and metric units are applied, **the calculation will be greatly simplified by rounding up to 0.5 meters per cubit**.

Capacity (volume): *ephah*, *bath* etc.

I summarize some of the assumptions (for details, see my earlier paper).

1. The manna's daily amount was an *omer*, and **the daily food ration is commonly seen at around 1 liter. Since 10 *omer* equal 1 *ephah*, we arrive at the *ephah* being approximately 10 liters**. This is for dry stuff.
2. A *homer* equals 10 *ephah*. Going by the above, that would be 100 liters. But the word *homer* could be derived from the word for donkey, and could mean “ass-load”, and a donkey can carry ca. 90 kg (so ABD), and 90 kg of grain [weight!] correspond to about 135 liters of grain [volume!]. **This points to an *ephah* that is larger than 10**

² Rounding *up* one value and rounding *down* another one should not be applied to the *same* object. For example, the measurements of Noah's Ark are given in Gen. 6:15 as 300 x 50 x 30 cubits. This matches a ratio of 30 : 5 : 3, and the ratio of its dimensions must not be changed. Going by 0.5 meters per cubit, this becomes 150 x 25 x 15 meters.

liters. Therefore we feel justified in rounding up any converted values quite generously.

3. Archeological findings relating to the *bath* suggest that **it contained 22 liters** (for liquid stuff). That conflicts with the 10-liter *ephah* deduced from the *omer*. Thus, in earlier times, **the *ephah* and the *bath* were not the same**.
4. Later, there was also the *double bath* with almost 40 liters. When that is multiplied by 10 in order to arrive at the amount for the *kor*, one ends up with a huge amount: HALOT's entry on the *kor* says:

For dry materials = חֲקִי, between 350 and 400 litres, Galling *Reallexikon* 367; de Vaux *Inst.* 1:303ff; Noth *Könige* 76 :: about 450 litres, Milik *Biblica* 40:985ff.

That would not be true in the earlier centuries.

5. Ezekiel (Ezek. 45:11–12) **increases the size of the *bath* and equates the *ephah* with it. That was an innovation.** We need to draw a line between preexilic and exilic/postexilic contexts. For example:
 - In Num. 28:5, where we find “a tenth of an *ephah*”, GNTD does well by saying “each [lamb] with a grain offering of 2 pounds of flour” – that is, roughly 1 kg.
 - Ezek. 45:24 says “With every bull and ram he is to provide a grain-offering of one *ephah*” (REB89). There, GNTD has “half a bushel of grain”, but it should be much more.

I find no English or German translation that makes a distinction to the preexilic value. But failing to do so does not go together with Ezekiel's own message. As to the French translations, they do not make this distinction either. But some of them agree in using a much higher value than the English translations: In Num. 28:5, FRC97, PDV2017 and NFC (2018) have 3 kg for 1/10 of an *ephah*, thus calculating the *ephah* at 30 kg, and in Ezek. 45:24, likewise, they all fix the *ephah* at 30 kg. I believe this number is fairly fitting in Ezekiel, but too high in the Pentateuch.

“Catch all” (1): the tenth of an *ephah*

The word עֶפָה *ēpah* itself occurs 40 times.

As to “a tenth of an *ephah*”, that can be expressed in two ways,

- either by עֶשְׂרִית הָאֵפָה “*‘sîrît hā’ēpah* ‘a tenth of an *ephah*’.
 - or by the special word עֶשְׂרֹן *‘issārôn*.
- This occurs in Exod. 29:40, and 32 more times.

In order to apply the same conversion in all places, **both these expressions need to be included in a search.**

A hint about the *hin* [הֵין]

The *hin* is 1/6 of a *bath*. If the (pre-exilic) *bath* equals 22 liters, the *hin* equals circa 3.7 liters. This amount makes the calculation for oil and wine in the offerings tricky. Firstly, the amount itself is uneven; secondly, with the *hin*, we get fractions in the text, like “a fourth of a *hin*”; thirdly, ideally, the ratios are to be kept.

The table below gives values for oil and wine as we find them in Num. 15:4ff. and 28:5ff.

Hebrew text	Equivalent in liters (rounded up)	Ratio	Suggested further rounding	Ratio
1 hin	4 liters	12	4 liters	12
1/2 hin	2 liters	6	2 liters	6
1/3 hin	1.3 liters	4	1.5 liters	4.5
1/4 hin	1 liter	3	1 liter	3

Using “4 liters” as an equivalent is already a rounded figure. It divides nicely where you get “half a hin” or even “a fourth of a hin”. Problematic remains “a third of a hin”.

The translator has the choice between following the more exact calculation and insert the crooked “1.3 liters”, or applying further rounding to, say, “1.5 liters” instead, and accept some distortion of the ratios.

The weight of grain and flour

As to the weight of grain, translators might decide to convert volume (liters) into weight (kilos), where this matches their culture better. On page 19 of my paper, I suggested to apply a “rule-of-thumb ratio” of 1 liter matching 2/3 of a kilo in grain. This could be done more precisely. Using a variety of websites, I came to these results:

Approximate weights per liter	
wheat (grain) 0.8 kg	wheat flour 0.6 kg
barley (grain) 0.6 kg	barley flour 0.4 kg

Thus, the differences are not insignificant: Using the same container, the weight of *barley flour* could be half of that of *unground wheat grain*! For example:

Gideon prepared bread from an *ephah* of קֶמַח *qemah* (common barley flour) (Jdg. 6:19). This would be around 4 kilo.

Jesse sent David to his brothers with an *ephah* of קָלִי *qālī* (roasted [unspecified] grain) (1Sam. 17:17). This would be around 7 kilo.

Also consider larger amounts. In 1Ki 5:2 [English 4:22], we read:

Solomon’s provision for one day was 30 kors of wheat flour and 60 kors of barley flour.

30 *kors* are at least 3,000 liters, but that is only somewhere around 1,800 kilograms (in wheat flour).

The above-mentioned “rule-of-thumb ratio” still makes sense for grain, but for flour it could be closer to 2:1.

Simplified conversion ratio	capacity : weight
grain	3 : 2
flour	2 : 1

(Depending on the degree of precision that one strives at, one could differentiate between wheat and barley.)

The texts below all talk about “one *ephah*”. That is 10–15 liters, or 5–10 kilos (see above).

- In Judg. 6:19, Gideon prepares bread from an *ephah* of flour for the angel.
- In Ruth 2:17, Ruth gleans about an *ephah* of barley.
- In 1Sam. 1:24, Hannah takes one *ephah* of flour to the sanctuary.
- In 1Sam. 17:17, Jesse sends an *ephah* of roasted grain to his sons in the camp.

In all these texts, the amounts should come across as normal or generous, but not unrealistically high.

“Catch all” (2): the ellipsis of *shekel*

The word שֶׁקֶל *šeqel* occurs 88 times. But sometimes the word *shekel* is omitted (“ellipsis”), because the meaning was self-evident for the original readers.

For example, in Gen. 20:16, Abimelech says to Sarah, literally: “I give thousand of silver to your brother”, meaning “I give thousand [shekels] of silver to your brother”.

Even the word for *silver* can be missing when it has been mentioned before (see Exod. 38:28).

This complicates our searches that we perform in order to check our translations for consistency. **The list of verses where the *shekel* is in view, but the word does not show up**, includes at least the following places:³

Gen. 20:16; 24:22; 37:28; 45:22; Exod. 30:23–24; 38:28; Num. 7:14–80, 86;
Deut. 22:19, 29; Jdg. 8:26; 17:2–4, 10; 2Sam. 18:11, 12; 21:16; 1Ki. 10:16, 29;
2Ki. 5:5; 6:25; 2Chr. 1:17; 9:15, 16; SoS. 8:11; Isa. 7:23; Hos. 3:2.

Further note that the value of the so-called *beka* [בֶּקָה *beqa*] (found in Gen. 24:22; Exod. 38:26) is the same as “half a *shekel*” (found in Exod. 30:13, 15; 38:26).

Finally, we mention the *pim* [פִּיַם *pîm*], which only occurs in 1Sam. 13:21, and is commonly taken to be equivalent to “two-thirds of a *shekel*”.

In Neh. 5:15; 10:33, possibly, instead of the Hebrew *shekel* weight, it is the Babylonian *shekel* coin that is meant.

Weight: The *shekel* (שֶׁקֶל *šeqel*)

The main unit for weight is the *shekel*. One *shekel* weighed about 11.4 grams. It will simplify the conversion of the measurements for weight greatly if we **round up this value and reckon with a *shekel* of 12 grams** (as in the German HFA).

The *shekel* can be used in two ways:

- (1) **for weighing objects** (e.g. one silver dish weighing 130 *shekels*, Num. 7:13),
- (2) **functioning as currency (“money”)** – usually by weighing silver (e.g. “a seah of flour will sell for a *shekel* [of silver]”, 2Ki. 7:1).

We find the two different uses side by side in Exod. 38:24–29: the gold, and probably the bronze too, came from jewelry (see 35:22, 24), but the silver from the census tax (compare 30:13).

Translators should decide how to handle these different cases.

For instance, GNTD measures the weight of the silver and gold vessels in Num. 7:12–86 in “ounces” and “pounds”, but for the payment for redeeming people in Lev. 27:3–7, it uses “pieces of silver”.

³ The list was rather incomplete in my earlier paper (p. 20).

We know that coins were not introduced until a much later time. Therefore, speaking of “pieces of silver” is an anachronism. It can be justified, but the approach taken should be explained in the introduction.

Even if coins were not used until much later, from the many texts that speak of silver being used for payment we see that the ancient Hebrews had a way of cutting up silver in quite reliable amounts. (E.g., in 1Sam. 9:8, Saul’s servant says to him: “Look, I have in my hand a fourth of a shekel of silver”.)

ISBE explains (vol. 3, p. 403):

Metals used as a medium of exchange increasingly were formed into standardized shapes. Egyptian bas-reliefs show piles or bundles of silver. According to Gen. 42:35 the sons of Jacob tied their silver in bundles when traveling to Egypt to purchase grain; Dt. 14:25 also implies the use of strips of silver bundles together. By ca. 1500 B.C. metal bars, ingot, tongues, and animal heads, in addition to flat discs and then rings made of gold, were used for commercial transactions.

The following lists might help translators when they consider which approach will be appropriate in their language and culture.

Examples for objects that are weighed in *shekel*:

- the vessels given by the tribal chiefs (Num. 7:12–86)
- cassia as an ingredient for the holy oil (Exod. 30:24)
- Absalom’s hair (2Sam. 14:26)

Examples for items that are paid in *shekels* [usually of silver]:

- flour and grain (2Ki. 7:1, a seah of flour sold for a *shekel*)
- slaves (Gen. 37:28, Joseph sold to the Midianites for 20 *shekels*)
- property (Gen. 23:15–16, Abraham buying Ephron’s field; 2Sam. 24:24, David buying the threshing floor; Jer. 32:9, Jeremiah “weighing out the silver” for his uncle, to buy a field)
- penalties (Exod. 21:32, goring ox – 30 *shekels*; Deu 22:19, defaming a virgin – 100 *shekels*; Deu 22:29, rape – 50 *shekels*.)
- taxes (2Ki. 15:20, Menahem collecting 50 *shekels* from every wealthy Israelite, to pay the king of Assyria; Neh. 5:15, governors imposing a 40-*shekels* tax)

The *shekel* in the Pentateuch

There is a concentration of *shekel* figures in the Pentateuch, to be more precise, in:

- Exod. 38 (collection for the Tabernacle), [weight and currency]
- Lev. 27 (redemption of vowed items) [currency]
- and Num. 7 (tribal chiefs’ dedication offering) [weight].

These are cases where the ratios (proportions) between various amounts (and their sums) have to match.

Exod. 38:24–29 is especially tricky. It lists the amounts of gold, silver, and bronze given for the Tabernacle.

The details are given in the table below.

Exod. 38	NASB	Conversion into kilo @ 12-g shekel	Rounded
v. 24: gold	29 talents + 730 shekels	1,052.76 kg *	1,053 kg
v. 25: silver	100 talents + 1,775 shekels	together 3,621.3 kg **	3,621 kg
v. 26	a beka a head, that is, half a shekel for 603,550 men	603,550 men x 6 grams / man = 3,621.3 kg	3,621 kg
v. 27: silver (a)	100 talents	3,600 kg	3,600 kg (3.6 tons)
v. 28: silver (b)	+ 1,775 shekels	21,3 kg	21 kg
v. 29: bronze	70 talents + 2400 shekels	2,548.8 kg	2,549 kg

* Equating 1 talent with 3,000 shekels means that 29 talents are 87,000 shekels; adding the separate 730 shekels results in 87,730 shekels; multiplying them by 12 grams makes 1,052.76 kilograms.

** Equating 1 talent with 3,000 shekels means that 100 talents are 300,000 shekels; adding the separate 1,775 shekels results in 301,775 shekels; multiplying them by 12 grams makes 3,621.3 kilograms.

When drafting the translation of this and other passages in the Pentateuch, I suggest these steps:

- Start with Exod. 38:26, where the amount per person is defined. (And compare with Exod. 30:13–15.)
- Calculate v. 25, which is based on the above-mentioned unit.
- Calculate vv. 27–28, which have to match v. 25 in the sum.
- Add v. 24 (gold) and v. 29 (bronze). For these, there are no ratios that we would need to render precisely.
- Move to Lev. 27:3–7 and make a table. The ratios between the numbers have to be kept intact.

The chapter speaks of 50 / 30 / 20 / 10 / 5 / 3 / 15 / 10 *shekels* (and in v. 16 of “50” again).

These figures correspond to 600 / 360 / 240 / 120 / 60 / 36 / 180 / 120 grams.

- Move on to Num. 7:13–86. The passage speaks of three types of vessels. They weigh 130, 70, and 10 *shekels* respectively. It is perhaps not so important to keep the ratios between these weights intact, but the sums in vv. 85–86 must match up with the weight of each piece.

vessel	silver dish	silver bowl	gold pan
weight	130 shekels	70 shekels	10 shekels
ratio	13	7	1
ratio of sums (silver : gold)	20		1

For a pragmatic rendering, I suggest:

rounded equivalent	1.5 kilograms	800 grams	115 grams
sum (in vv. 85–86)	$(1.5 \text{ kg} + 800 \text{ g}) \times 12 = 27 \text{ kg } 600 \text{ g}$		$115 \text{ g} \times 12 = 1 \text{ kg } 380 \text{ g}$

The suggestion above is a compromise:

The advantages are that it uses reasonably round figures, and keeps the ratio between the first and the last item intact (13 : 1), and the ratio of “all silver : all gold” as well.

The disadvantages are that it does not keep fully intact the ratios concerning the silver bowls, nor is it consistent with other texts: if we calculate with a 12-g *shekel*, then “10 *shekels*” become 120 g (as we had it in Lev. 27, see above); but here in Num. 7, we have 115 g instead. However, if we were to use 120 g here as well (for the gold pans), then the first figure (for the silver dishes) would have to be 1.56 kg, thus it would not be round anymore.

For a comparison, we take a look at GNTD’s solution, which uses ounces.

GNTD	50 ounces	30 ounces	4 ounces
ratio	12.5	7.5	1

Like our proposal above, this also offers quite round numbers and almost preserves the original ratios.

An alternative would be to strictly apply 10 grams per *shekel* in this passage. That would keep the ratios and allow for round numbers (1.3 kg / 700 g / 100 g), but the conversion would deviate more significantly from the 12 grams applied elsewhere.

➤ Go through the remainder of the Pentateuch with its individual stories, like for example:

- In Gen. 37:28, the price for which Joseph was sold to the Ishmaelites is 20 *shekels* of silver.
- In Num. 31:52, the tribute from the Midian booty is 16,750 *shekels* of golden items.

Apply the standard conversion of 12 grams for 1 *shekel* – rounded up or down as appropriate.

More on intertextual consistency

The four places below are thematically related, and they happen to contain *shekel* amounts in the ratios (proportions) of 1 : 10 : 100.

Reference	Theme	Hebrew Unit	Metric Value
Exod. 30:13–15	ransom price when a census is taken	0.5 shekels / person	6 grams
Num. 18:15–16	redemption price for the firstborn son	5 shekels / person	60 grams
Num. 3:47–50	redemption of the 273 firstborn	5 shekels / person; sum: 1,365 shekels	60 grams; sum: 16.38 kg
Lev. 27:3ff.	assessment for redeeming a man	50 shekels / person	600 grams

In translation, it would be good to avoid using *weight* in some of these places, and *money* in others, or to round the amounts in such a way that the proportions are distorted. In other words, keeping 6 / 60 / 600 grams, as in the table, makes it easy to compare the texts. (In Exodus, GNTD does not give any amount at all.)

The *gerah* (גֵּרָה *gērah*)

The *gerah* shows up **only and always in the definition “The *shekel* is twenty *gerahs*”** (although the exact wording varies). The verses are these:

Exod. 30:13; Lev. 27:25; Num. 3:47; 18:16; Ezek. 45:12

For how to deal with such definitions that the Hebrew author himself provides, see my separate paper.⁴ Here, I only present one option for dealing with it, using Exod. 30:13 as example:

NASB: This is what everyone who is counted shall give: half a shekel according to the shekel of the sanctuary (the shekel is twenty *gerahs*).

We may use a modern unit, and take the Biblical author’s explanatory note as a “template”, as it were, and replace it with a “modern” explanatory note that is relevant for our target audience, and add the literal translation in a footnote. Thus:

This is what everyone who is counted shall give: six grams, weighed by the sanctuary’s standard / scales) (the basic unit equals / corresponds to 12 grams).
[Footnote: Literally, the shekel is twenty *gerahs*.]

The talent (כִּכְאָר *kikkār*)

The word *kikkār*, used as a weight, occurs 47 times. A talent equals 60 *minas*, or 3,000 *shekels*. With our 12-gram *shekel*, this results in 36 kg. It seems reasonable to **calculate with a round amount of 35 kg**. E.g.:

- About the crown of the Ammonite king, it says (2Sam. 12:30): “It weighed 35 kilograms” [Orig. “Sie wog 35 Kilogramm”] (German HFA).
- Naaman offers Gehazi a gift of two talents (2Ki. 5:23). T4T says “150 pounds”.

⁴ Peter Schmidt, “Toward a Best Practice in Representing the Authors’ Explanatory Notes in Old Testament Translation,” *Journal of Translation*, vol. 14, no. 1, 2018, pp. 1–28, especially section 3.2.3. <https://doi.org/10.54395/jot-8c3tv>.

Aramaic measurements

For a full treatment of measurements, the Aramaic vocabulary has to be included.

The Aramaic word for ‘cubit’ is spelled in the same way as in Hebrew, אַמָּה *ammah*, and is found in Ezra 6:3 (twice) and Dan. 3:1 (twice).

The Aramaic words בַּת *bat*, כֹּר *kōr* and כַּכְּר *kakkar* ‘talent’ all occur in Ezra 7:22 (only).

The words מִנָּא *mānē* ‘mina’, תַּקֵּל *taqēl*, (the equivalent for Hebrew *shekel*) and פָּרֶס *pārēs* (HALOT: “traditionally **one-half of a mina**, rather **one-half of a shekel**”; but uncertain) occur in Dan. 5:25–28. They are all part of “the writing on the wall” and are not associated with any numbers. Therefore they are not relevant here.

Time: The Aramaic word for ‘month’, יָרַח *yārāḥ*, is found in Ezra 6:15 and Dan. 4:26.