To: EurOtp manual authors
From: Daan Heineke, The Netherlands
Subject: Comments EurOtop manual dated August 07
Date: November 21, 2007

General

1. **Notation**: Some parameters are denoted with normal font notation, eg Hs (without subscript); but others are in italic font with subscript (eg V_{max}); to be consistent, this would better be all in italic font (as in some or part of some equations; see eg formula 1.1. below); moreover, some confusion may arise when italic font is used in the main text while on the same page in a Figure normal font is used for the same parameter.
2. **Rock vs armourstone**: It would be better and consistent to use "rock" for the basic material ("rock-armoured slopes" or "rock structures" or "rock revetments" is okay) and armourstone for the aggregate of the stones in the structure; this is then in compliance with EN 13383 (and similar to what is used in Rock Manual). The individual pieces should then be called (armour) stones. NOTE: "Armour" is actually the outside protection (layer), not the material.
3. **Steepness**: as expressed in earlier mail messages, I suggest to use the wording *fictitious wave steepness*, simply to avoid confusion when this parameter [$s_o = 2\pi H_{m0}/(gT_{m-1,0}^2)$, both height and period at the toe of the structure] is meant instead of the real steepness. H/L. The problem as discussed earlier remains that the use of L_o is not in all cases the real deep-water wavelength; the wave period is in some cases not only flattened out due to breaking, but also shifting as for its peak or mean value. That's why I am not happy with the use of L_o, while actually the characteristic wave period that is present in front of the structure, is relevant. Moreover the definition even gives "deep water" wavelength, which is wrong.
4. **Wave length**: it should read wavelength instead of wave length (wave height and wave period are both two words, not wavelength).
5. **Often**; this is in many instances not fully correct English, as in many instances "in many cases" is actually meant. To a lesser extent this also applies to "*sometimes*".
6. **Which or that**: in many instances the use of the word which is not correct: it should be either ",which" [with a comma] to indicate an additional information of the word or sentence just in front, or "that" [without a comma] to specifically indicate which subject is meant: "the formulae that describe the overtopping, should be used with care" versus "the overtopping formula of TAW, which has been discussed in section x.y, has some drawbacks".
7. **Ref to Rock Manual**: the correct reference nowadays, with the 2007 version of the Rock Manual available, is: CIRIA, CUR, CETMEF (2007). See e.g. the Preface, Introduction (p 1, p 2) Refs (p 161).
8. **The use of σ and σ'**: this parameter is defined as the standard deviation and the coefficient of variation respectively; but also direction spreading, which is in some instances confusing for the reader, in particular when it is for example simply stated in a sentence "(σ = 0.14)".
9. **Breaker parameter ksi**: why to add that "o" in the index? This is giving the impression that it has something to do with deep-water, which is incorrect; I suggest therefore to simply delete all "o" 's from the subscripts of ksi; moreover, the correct symbol is ξ, not: ζ, as it seems to be in listing in Notation; also here: a zero is used as index! I prefer "o".

ζ_o	= breaker parameter based on s_0 (= $\tan\alpha/s_0^{1/2}$)	[-]
ζ_{om}	= breaker parameter based on s_{0m}	[-]
ζ_{op}	= breaker parameter based on s_{0p}	[-]

Prelims

Page ix:

- L_0 to read: L_o the index "0" is very confusing

Same page ix:

I think "Equation 5.9" has to read "Equation 5.8"

Page x

- This is not rock slopes! That is in a natural site with original rock eg in a quarry when the material is still in the mountain! Should read: "rock-armoured slopes" – both in Fig 6.2 and in Fig 6.5
- Title of Figure 6.3 seems to be odd: is something missing?
- Title of Figure 6.2: I have been taught that compare to is comparing unlike things: (eg "compared to an ape he is rather nice looking"), but to use "compare with" when like things are compared with each other.
- "armour size" in the Title of Figure 6.3 to read: "armourstone size"; "armour" is the entire cover layer – the protection

Same page x:

The symbols for the various parameters are in italic font here. I like this way, but it is not consistent across the manual; and moreover: in that case (italic font), such should not be done for figures, eg H_{m0} instead of H_{m0}! The zero is for zeroth moment.

Page xi:

- Here h_* is called: "impulsiveness parameter". So a name! I have understood where this comes from, but it doesn't read easily. That's why I would say: "Impact parameter". Apart from that: see title of section in chapter 1! "Parameter h_* " without any real name.
- "discharge which has landed" → "discharge that has landed" or alternatively: "discharge landed"

Main text:

Page 2:

> A second type of coastal structure consists of a mound or layers of quarried rock fill, protected by rock or concrete armour units. The outer armour layer is designed to resist wave action without significant displacement of armour units. Under-layers of quarry or crushed rock support the armour and separate it from finer material in the embankment or

- "rock or concrete" → "armourstone or concrete"
- "quarry or crushed rock" should this be: "quarried or crushed rock"? I think so.

Page 4:

> 1.4.3 Wave steepness and Breaker parameter
>
> Wave steepness is defined as the ratio of wave height to wavelength (e.g. $s_0 = H_{m0}/L_0$). This will tell us something about the wave's history and characteristics. Generally a steepness of $s_0 = 0.01$ indicates a typical swell sea and a steepness of $s_0 = 0.04$ to 0.06 a typical wind sea. Swell seas will often be associated with long period waves, where it is the period that becomes the main parameter that affects overtopping.

- "s_0" is not correct; → "s_o"; "L_0" is not correct, → "L_o"
- I would suggest to add a few words in the first sentence to express the fact that the wave <u>period</u> was meant to be introduced in the formulae and that the local conditions are important, thus adding the word 'fictitious'; eg "wavelength (eg $s_0 = H_{m0}/L_0$). This will" → "wavelength, $s = H/L$. The *fictitious* wave steepness is defined as the ratio of the wave height at the toe of the structure and the *fictitious* deep-water wavelength, equal to $gT^2/(2\pi)$, eg $s_{om} = H_s/L_{om}$, where L_{om} is the fictitious wavelength based on the local value of the mean wave period T_m, or $s_{m-1,0} = H_{m0}/L_o$, where L_o is the (fictitious) deep-water wavelength based on the mean energy wave period $T_{m-1,0}$: $L_o = g(T_{m-1,0})^2/(2\pi)$. This will ".

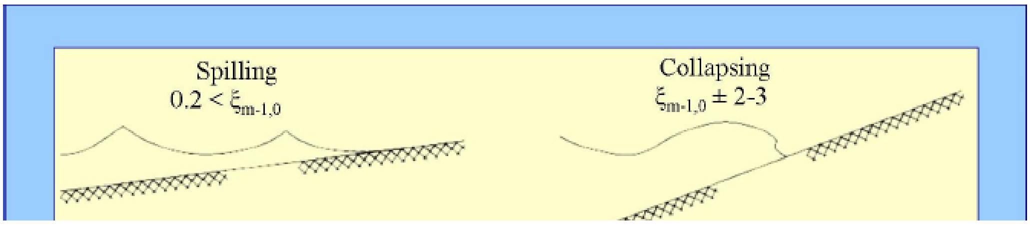
  Please note that in this way it is consistent with definition further down in the document.

Same page 4:

> The breaker parameter, surf similarity or Iribarren number is defined as $\xi_{m-1,0} = \tan\alpha/(H_{m0}/L_{m-1,0})^{½}$, where α is the slope of the front face of the structure and $L_{m-1,0}$ being the deep water wave length $gT^2_{m-1,0}/2\pi$. The combination of structure slope and

- It is the surf similarity <u>parameter</u>! The text suggests now that it is a surf similarity number; "The breaker parameter, surf similarity or Iribarren number is" → "The breaker or surf similarity parameter, also called the Iribarren number, is".
- It is the 2nd power of the mean energy wave period; therefore: "$T^2_{m-1,0}$ " → "$T_{m-1,0}^2$ " or "$(T_{m-1,0})^2$ ".
- Here we have the definition problem again: $L_{m-1,0}$ is not by definition the deep-water wavelength! It is actually a kind of fictitious wavelength defined as $g(T_{m-1,0})^2/(2\pi)$, where $T_{m-1,0}$ is the wave period at the toe of the structure whatever the water depth. Moreover, the definitions in Notation says: L_0 (actually L_o) is the deep-water wavelength based on the $T_{m-1,0}$. So here is an inconsistency; I suggest to forget about this $L_{m-1,0}$ in the case of wave steepness and related ksi values. Either use L_o and define it again (I did it already in the paragraph above!) or even better define it as: $\xi_{m-1,0} = \tan\alpha/\sqrt{s_{m-1,0}}$, where α is the structure's front face slope and $s_{m-1,0}$ is the fictitious wave steepness based on H_{m0} and $T_{m-1,0}$ (see above)" . [provided the text above is also used as suggested]

Page 5: Figure 1.1



In the text below the figure it is stated: spilling when ksi < 0.2!

Page 6:

1.4.4 Parameter h_*

In order to distinguish between non-impulsive (previously referred to as pulsating) waves on a vertical structure and impulsive (previously referred to as impacting) waves, the parameter h_* has been defined.

$$h_* = \frac{h_s}{H_s}\frac{h_s}{L_o} \qquad 1.1$$

The parameter describes two ratios together, the wave height and wave length, both made relative to the local water depth h_s. Non-impulsive waves predominate when $h_* > 0.3$; impulsive waves when $h_* \leq 0.3$. Formulae for impulsive overtopping on vertical

- Suggest to give this parameter a name; it is odd to read "parameter h_*"; my suggestion is: "**Wave impact parameter**", or to be consistent with text in ch 7: "**Impulsiveness parameter**".
- Again, the deep-water wavelength is not relevant; it is the wave period that is important; so I suggest to slightly change the text (if L_o has to be kept in the formula): "and wave length, both" to read: "and fictitious wavelength, equal to $gT^2/(2\pi)$, both "
- The transition in this section is not the same as what is given in chapter 7 – page 131 (see copy below); it is nice to read there that the definition is correct in the sense of 'fictitious' wavelength.
- It is unclear why the factor "1.35" is appearing there in chapter 7, whereas this is not appearing in Eq. 1.1.

For submerged toes ($h_s > 0$), a wave breaking or "impulsiveness" parameter, h_* is defined based on depth at the toe of the wall, h_s, and incident wave conditions inshore:

$$h_* = 1.35\frac{h_s}{H_{m0}}\frac{2\pi h_s}{gT_{m-1,0}^2} \qquad 7.1$$

Non-impulsive (pulsating) conditions dominate at the wall when $h_* > 0.3$, and impulsive conditions occur when $h_* < 0.2$. The transition between conditions for which the overtopping response is dominated by breaking and non-breaking waves lies over $0.2 \leq h_* \leq 0.3$. In this region, overtopping should be predicted for both non-impulsive and impulsive conditions, and the larger value assumed.

Page 6:

the wave height at the toe; or end of the foreshore; can be considered. A foreshore is defined as having a minimum length of one wavelength L_o. In cases where a foreshore

Is L_o correct? Or rather, simply the words: "one wavelength"? L_o has been defined as the deep-water wavelength, which is incorrect, but if it is the fictitious wavelength, as it should be, then leave it as it is.

Page 7:

Generally speaking, the transition between shallow and very shallow foreshores can be indicated as the situation where the original incident wave height, due to breaking, has been decreased by 50% or more. The wave height at a structure on a very shallow foreshore is much smaller than in deep water situations. This means that the wave

Other references talk about energy decrease by 50%; so when the wave height is smaller than 70% of that in deep water, the foreshore is very shallow; see eg Rock Manual and publications Van Gent.

Same page 7, a few lines lower:

steepness (Section 1.4.3) becomes much smaller, too. Consequently, the breaker parameter, which is used in the formulae for wave run-up and wave overtopping, becomes much larger. Values of ξ_0 = 4 to 10 for the breaker parameter are then possible, where maximum values for a dike of 1:3 or 1:4 are normally smaller than say ξ_0 = 2 or 3.

Why use the index “0”? In $\xi_{m-1,0}$ there is no such zero added. Only in exceptional cases – eg section 2.4 / page 22 – I would add such additional deep-water indication (an “o” then instead of a zero!) to indicate that we mean deep-water conditions. Otherwise no such subscript, also to avoid confusion!

Same page 7; section 1.4.7

when a line is drawn between -1.5 H_{m0} and +$Ru_{2\%}$ in relation to the still water line and berms are not included. A continuous slope with a slope between 1:8 and 1:10 can be

“$Ru_{2\%}$” → “$R_{u2\%}$”

Page 9:

A rubble mound breakwater often has an under layer of large rock (about one tenth of the weight of the armour), sometimes a second under layer of smaller rock and then the core

“rock” → “armourstone”; “weight of the armour” → “mass of the armourstone”; and “smaller rock” → “smaller stones”

Page 10:

A rubble mound breakwater often has an under layer of large rock (about one tenth of the weight of the armour), sometimes a second under layer of rock and then the core of small rock. Up-rushing waves can penetrate into the armour layer and will then sink into the under layers and core. This is called a structure with a “permeable core”.

An embankment can also be covered by an armour layer of rock. The under layer is often

- “large rock” → “heavy armourstone “ [ref to EN13383] [large is ref to size!
- “weight of the armour” → “mass of the armourstone, D_{n50}”
- “under layer of rock and then the core of small rock” → “underlayer of armourstone and then the core consisting of relatively small stones”
- “an armour layer of rock” → a rock armour layer” or “rock-armoured slope”

Same Page 10:

1.4.11 Wave run-up height

The wave run-up height is given by $R_{u2\%}$. This is the wave run-up level, measured vertically from the still water line, which is exceeded by 2% of the number of incident waves. The number of waves exceeding this level is hereby related to the number of

“, which is exceeded by 2%” → “, that is exceeded by 2%” or alternatively: “, exceeded by 2%” [see general remarks]

Page 13:

- Human errors: all of the errors during production, abrasion, maintenance as well as other human mistakes which are not covered by the model. These errors are not considered in the following, due to the fact that in general they are specific to the problems and no universal approaches are available.

"which are not covered" → "that are not covered"

Same page 13:

consequences: Firstly, the parameters have to be checked whether all realisations of this parameter are really physically sound: E.g., a realisation of a normally distributed wave height can mathematically become negative which is physically impossible. Secondly, parameters have to be checked against realisations of other parameters: E.g., a wave of a

- "negative which" → "negative, which"
- The word realisation(s) is ambiguous / unclear language. What is meant?

Page 14:

1.5.4 Model uncertainty

The model uncertainty is considered as the accuracy, with which a model or method can describe a physical process or a limit state function. Therefore, the model uncertainty describes the deviation of the prediction from the measured data due to this method.

"accuracy, with which" → "accuracy with which" [no comma]

Page 15:

Key models for overtopping will be calculated using all uncertainties and applying a Monte-Carlo-simulation (MCS). Statistical distributions of outputs will be classified with regard to exceedance probabilities such as: very safe, where output is only exceeded by 2% of all results, corresponding to a return period of 50 years which means that the structure is expected to be overtopped only once during its lifetime of 50 years; safe,

"50 years which" → "50 years, which"

Page 17:

For design of structures, which last a long time after its design and construction phase, a certain sea level rise has to be included. Sometimes countries prescribe a certain sea level rise, which has to be taken into account when designing flood defence structures.

- "structures, which" → "structures that"
- "Sometimes countries …. has to be taken into account etc" → "Some countries prescribe a certain value of level rise to be taken into account .. etc"

Page 19:

2.2.4 High river discharges

Coastal flood defences face the sea or a (large) lake, but flood defences are also present along tidal rivers. Extreme river discharges determine the extreme water levels along river flood defences. During such an extreme water level, which may take a week or longer, a storm may generate waves on the river and cause overtopping of the flood defence. In many cases the required height of a river dike does not only depend on the

"During such an extreme water level, which" → "During periods of such extreme water levels, which"

Page 20:

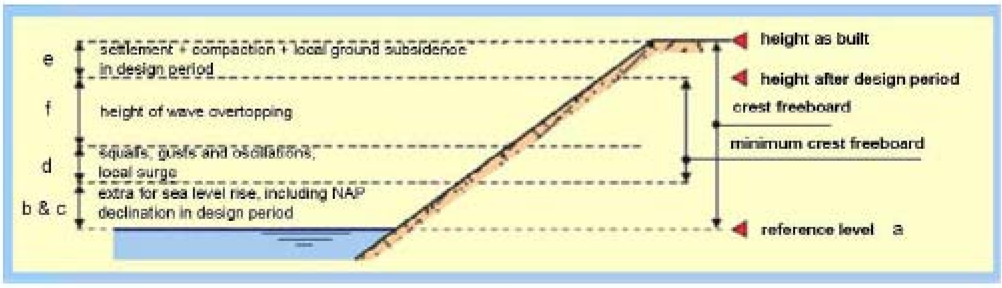


Figure 2.2: Important aspects during calculation or assessment of dike height

The structure height of a dike in the Netherlands is composed of the following contributions; see also the Guidelines for Sea and Lake Dikes [TAW, 1999-2]:

a) the reference level with a probability of being exceeded corresponding to the legal standard (in the Netherlands this is a return period between 1,250 and 10,000 years;

- “design period” → “design life period” (3 times in the figure and in the text below figure)
- “is composed of” → “is determined by and comprises” (?)
- “1,250 and 10,000” → “1250 and 10 000”
- Aspect **f** in the figure: is this “wave overtopping?? I think: “ 2% wave run-up “

Same Page 20:

Contributions (a) to (d) cannot be influenced, whereas contribution (e) can be influenced. Contribution (f) also depends on the outer slope, which can consist of various materials, such as an asphalt layer, a cement-concrete dike covering (stone setting) or grass on a clay layer. A combination of these types is also possible. Slopes are not always straight, and the upper and lower sections may have different slopes and also a berm may be applied. The design of a covering layer is not dealt with in this report. However, the

“a cement-concrete dike covering (stone setting)” → “a cement-concrete or pitched stone dike cover layer (placed blocks)”

Page 22:

is represented in computational models. The most frequent method for doing this is to define an energy dissipation term which is used in the model when waves reach a limiting depth compared to their height.

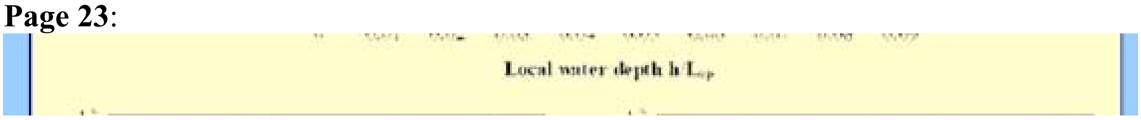
- “frequent” → “frequently used”
- “term which” → “term that”
- “a limiting depth compared to their height” → “a depth limited by their height” (?)
  “compared to” is not correct anyhow! When you compare unlike things “to” is used, otherwise “with”.

Same page 22:

design graphs from this model are accurate for slopes ranging from 1:10 to 1:100. For slopes flatter than 1:100, the predictions for the 1:100 slopes should be used.

A flat slope is odd language; typically UK; better to use either “more gentle” or “milder”

Page 23:



The right wording is “Relative local water depth” - 5 times in this Figure

Page 24:

$$H_{m0} = 4\sqrt{m_0} \quad H_{m0} = 4\sqrt{m_0} \qquad 2.1$$

"Find the mistake"

Page 26:

If no information on statistical distributions or error levels is available for water levels or sea state parameters the following assumptions should be taken: all parameters are normally distributed; significant wave height H_s or mean wave height H_{m0} have a coefficient of variation σ_x' = 5.0%; peak wave period T_p or mean wave period $T_{m-1.0}$ have a coefficient of variation σ_x' = 5.0%;and design water level at the toe σ_x' = 3.0%, see Schüttrumpf *et al.* (2006).

"or mean wave height H_{m0} have" is this the spectral significant wave height"? or is the symbol incorrect?

Same page 26:

Guidance on hydraulic boundary conditions for the safety assessment of Dutch water defences can be found in Hydraulische Randvoorwaarden, RWS 2001 (Due to be updated in 2007).

Has this update been materialised? It is already 2007!

Page 28:

3.1.2 Types of overtopping

Wave overtopping which runs up the face of the seawall and over the crest in (relatively) complete sheets of water is often termed 'green water'. In contrast, 'white water' or spray overtopping tends to occur when waves break seaward of the defence structure or break onto its seaward face, producing non-continuous overtopping, and/or significant volumes

"Wave overtopping which" → "Wave overtopping that"

Page 30:

It is well known that the Netherlands is low-lying with two-thirds of the country below storm surge level. Levels of protection were increased after the flood in 1953 where almost 2000 people drowned. Large rural areas have a level of protection of 10,000 years, less densely populated areas a level of 4,000 years and protection for high river discharge (without threat of storm surge) of 1,250 years.

- "the flood in 1953 where" → "the 1953 flood disaster in which "
- "Large rural areas" → "Large urban areas"
- "10,000" → 10 000"; 1,250" → 1250" ; "4,000" → "4000"

Page 31:

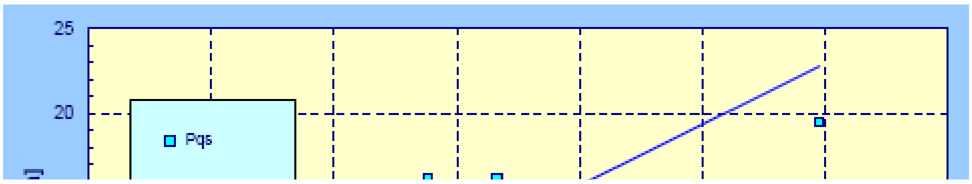
overtopping waters reduces with the distance away from the defence line. As a rule of thumb, the hazard effect of an overtopping discharge at a point *x* metres back from the seawall crest will be to reduce the overtopping discharge by a factor of *x*, so the effective overtopping discharge at *x* (over a range of 5 - 25m), $q_{effective}$ is given by:

$$q_{effective} = q_{seawall}/x \qquad 3.1$$

The definition given above the Figure is a bit odd for the reader; and also the wording used: the effective overtopping discharge is inversely linearly dependent upon the distance? So, at 5 m from the seawall the effective discharge is only 20% of the value at the seawall? Unclear guidance.

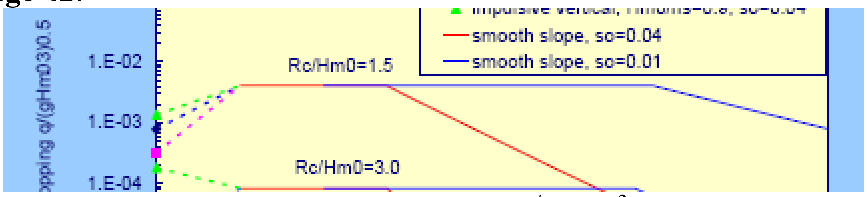
Page 35:

Pulsating wave pressures were measured on the secondary wall against the effective overtopping discharge arriving at the secondary wall, plotted here in Figure 3.3. This was deduced by applying Equation 3.1 to overtopping measured at the primary wall, 7m in front. Whilst strongly site specific, these results suggest that quite low discharges (0.1-1.0 l/s/m) may lead to loadings up to 5kPa.



Unclear guidance: Pqs is what? What does the text above the Figure mean?

Page 42:



Legend to y-axis is unclear: should read: $q/\sqrt{(gH_{m0}^3)}$

Page 44:

As example a smooth slope with slope angle 1:4 is taken, a rubble mound slope with a steeper slope of 1:1.5 and a vertical wall. The storm duration has been assumed as 2 hours (the peak of the tide) and a fixed wave steepness of $s_{0m-1,0}$ = 0.04 has been taken.

Here a zero is added in the subscript of the fictitious wave steepness, in other chapters / sections it is simply: $s_{m-1,0}$ – please be consistent. RM has the latter, although for consistency reasons it might be: $s_{om-1,0}$ (with an o, not a zero!).

Page 45:

$$K_t = \left[-0.3\cdot\frac{R_C}{H_{m0,i}} + 0.75\cdot\left(1-\exp\left(-0.5\cdot\xi_{0,p}\right)\right)\right]\cdot(\cos\beta)^{2/3} \qquad 4.5$$

with as a minimum Kt = 0.075 and maximum Kt = 0.8, and limitations 1 < ξop < 3,

The symbol "ξ_{op} " is not correct as the value at the toe is meant; should read: ξ_p; the same applies to the symbol in the line below the equation.

Page 46: 3rd line

structure). Three wave steepnesses have been used: $s_{0,p}$ = 0.01 (long waves), 0.03 and

"$s_{0,p}$" → "s_{op}"

Same page 46:

structure). Three wave steepnesses have been used: $s_{0,p}$ = 0.01 (long waves), 0.03 and 0.05 (short wind waves). Also perpendicular wave attack has been assumed. Wave

"$s_{0,p}$ " → "s_{op} "

Page 47:

$$K_t = -0.4R_c/H_{m0} + 0.64B/H_{m0} - 0.31\left(1-\exp\left(-0.5\xi_{op}\right)\right) \qquad 4.6$$

for $0.075 \le K_t \le 0.8$

ξ_{op} is not the correct symbol as the value at the toe is meant!! → ξ_p

Same page 47:

wave height of 3 m has been assumed with the following wave steepness: $s_{0m-1,0}$ = 0.01 (long waves), 0.03 and 0.05 (short wind waves). In the calculations the crest height has been changed to calculate wave transmission as well as wave overtopping.

Figure 4.8 gives the comparison. The graph shows that a longer wave ($s_{0m1,0}$ = 0.01)

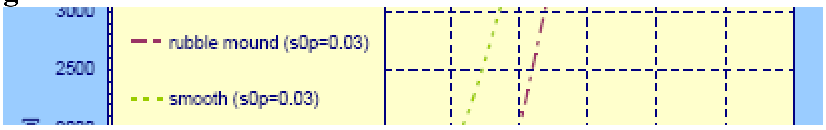
"$s_{0m-1,0}$ → "$s_{m-1,0}$" [2 times]; at least, not a zero!

Page 48:

4.5 m (3 D_{n50}) and a wave steepness s_{0p} = 0.03. The curve for a smooth structure (Figure 4.7) and for s_{0p} = 0.03 has been given too in Figure 7.24.

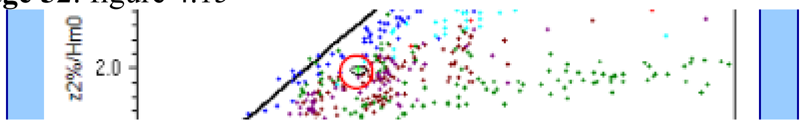
"s_{0p} = " → "s_{op} = " [2times]

Page 49:



"s0p" → "s_{op}"

Page 52: figure 4.15



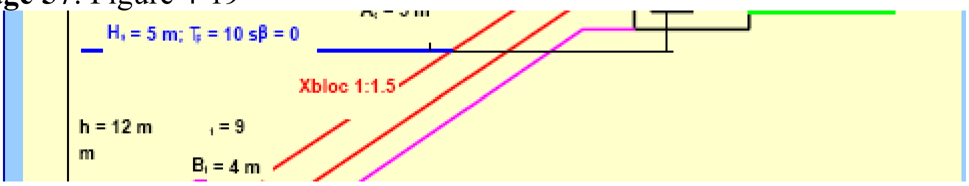
"z2%" → "$R_{u2\%}$" [$z_{2\%}$ is Dutch way!]

Page 53:

where the input layer has 15 input parameters (β, h, H_{m0toe}, $T_{m-1,0toe}$, h_t, B_t, γ_f, $cot\alpha_d$, $cot\alpha_u$,

Subscripts of numbers NOT italicised

Page 57: Figure 4-19



Is the toe depth 9 m? **h** of **h_t** is missing?

Page 58:

The wave conditions are $H_{m0\ toe}$ = 3 m, the wave steepness s_o = 0.04 ($T_{m-1,0}$ = 6.9 s) and

"s_o = " → "$s_{m-1,0}$ = " or "$s_{om-1,0}$ = "

Page 59 the same:

As still quite some data are remaining in Figure 4.22, it is possible to narrow the search area even further. With a wave steepness of s_o = 0.04 in the considered case, the wave

Page 64: Note to Table 4.3

With: $Fr_W=c/(g \cdot h)^{1/2}$; $Fr_A=v_A/(g \cdot h_A)^{1/2}$; $Fr_q=v_A/(2 \cdot g \cdot R_u)$; $Re_W = c \cdot h/v$; $Re_q=(R_u-R_C)^2/(v \cdot T)$; $We=v_A \cdot h_A \cdot \rho_W/\sigma_W$

Many of these symbols for parameters have not been defined!

Chapter 5:

Page 68:

breaker parameter $\xi_{m-1,0}$. The breaker parameter or surf similarity parameter $\xi_{m-1,0}$ relates the slope steepness tan α (or 1/n) to the wave steepness $s_{m-1,0} = H_{m0}/L_0$ and is often used to distinguish different breaker types, see Section 1.4.

"wave steepness $s_{m-1,0} = H_{m0}/L_0$" → "fictitious wave steepness $s_{m-1,0} = H_{m0}/(gT_{m-1,0}^2)$"

Page 68: 4th line from below: "Equation 5.11" → "Equation 5.1" (?)

Page 70

wave steepness H_{m0}/L_0 [-]

Figure 5.5: Relative Wave run-up height $R_{u2\%}/H_{m0}$ as a function of the wave steepness for smooth straight slopes

"wave steepness" → fictitious wave steepness"; "H_{m0}/L_0" → "$s_{m-1,0}$"; [that zero subscript of L is surely not correct]

Page 72: 2nd line below Fig 5-6

The statistical distribution around the average wave run-up height is described by a normal distribution with a variation coefficient $\sigma' = \sigma / \mu = 0.07$. It is this uncertainty which should be included in application of the formula. Exceedance lines, for example, can be

"It is this uncertainty which should be included in application of the formula. " → "This uncertainty should be included in the application of this formula."

Page 75:

As mentioned before, the average wave overtopping discharge q depends on the ratio between the freeboard height R_C and the wave run-up height R_u:

$$\frac{R_C}{R_u} \qquad 5.6$$

The wave run-up height R_u can be written in a similar expression as the wave run-up height $R_{u,2\%}$ giving the following relative freeboard height:

$$\frac{R_C}{c_{u,1} \cdot \xi_{m-1,0} \cdot H_{m0} \cdot \gamma_b \cdot \gamma_f \cdot \gamma_\beta \cdot \gamma_v} \quad \text{for breaking waves and a maximum of}$$

$$\frac{R_C}{c_{u,2} \cdot H_{m0} \cdot \gamma_f \cdot \gamma_\beta} \quad \text{for non-breaking waves} \qquad 5.7$$

The relative freeboard does not depend on the breaker parameter $\xi_{m-1,0}$ for non breaking waves (Figure 5.8), as the line is horizontal.

The expressions given in the boxes are no formulae or equations. Are things missing? It is a very strange text part. I have not seen that the overtopping depends on R_c/R_u. And R* is the dimensionless freeboard height, equal to R_c/H_{m0}, isn't it!
It is not clear for a reader, at least not clear for me. What is the intention of this text?

Same page 75:

Figure 5.8: Wave overtopping as a function of the wave steepness H_{m0}/L_0 and the slope

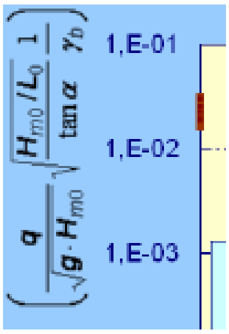
"wave steepness" → "fictitious wave steepness $s_{m-1,0}$ " [as mentioned earlier]

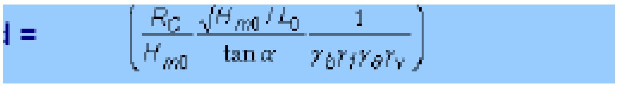
Page 75: first line vs last sentence Q_* and Q^*

The dimensionless overtopping discharge $Q^* = q/(gH^3_{m0})^{½}$ is a function of the wave height, originally derived from the weir formula.

What is the difference between the two; it seems that these are the same, but not clear! Refer also to various Figures further down in document. The same applies to R^* and R_*.

Page 76: Fig 5.9



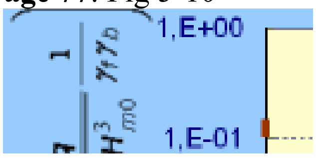


3[rd] power of H_{m0} is missing in legend to y-axis; I prefer to use $s_{m-1,0}$ instead of H_{m0}/L_0; γ_θ → γ_β

Page 77: general layout:

- I would suggest to shift Fig 5-10 to the top of the page (it is now confusing – see incorrect eq ref - below)
- The text para just above Fig 5-10 refers to another section – the paragraph starting at the end of page 78; so better to move that para to just below the Figures on page 78?.

Page 77: Fig 5-10

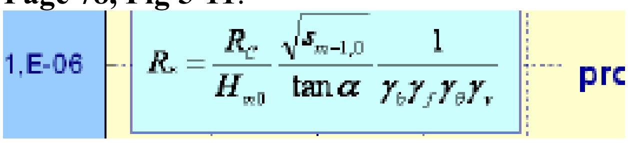


s and overtopping Equation 5.9 with 5%

caption of Figure

The term of $1/(\gamma_f\,\gamma_b)$ in the y-axis legend to be deleted; and "Equation 5.9" → "Equation 5.8"

Page 78, Fig 5-11:



γ_θ → γ_β

Page 79:

$$\frac{q}{\sqrt{g \cdot H^3_{m0}}} = 10^c \cdot \exp\left(- \frac{R_C}{\gamma_f \cdot \gamma_\beta \cdot H_{m0} \cdot (0.33 + 0.022 \cdot \xi_{m-1,0})} \right) \qquad 5.11$$

- The factor "10^c ". What should this be? [Unclear].

- 1st line above the Eq: “a mean of -0.92”. It is unclear what this is. Is the left hand side of this eq negative?

Page 80: Equation 5.13

$$\frac{q}{\sqrt{g \cdot H_s^3}} = Q_0 / \sqrt{s_{0,m}} \cdot \exp\left(-b \frac{R_c}{H_s \sqrt{s_{0,m}}}\right) \qquad 5.13$$

- “$s_{0,m}$ → “s_{om}“
- I think that the sqrt s_{om} term in the exponent is not “placed” correctly: in my view the equation should read:

$$\frac{q}{\sqrt{gH_s^3}} = \frac{Q_0}{\sqrt{s_{om}}} \exp\left(-b \frac{R_c}{H_s} \sqrt{s_{om}}\right)$$

However, when checking things, I conclude that both Q_0 and b are not the same parameters as those listed earlier in the section, viz. Eq 5.12; Q_0 → Q'_0 (= $Q_0 \sqrt{2\pi}$) and b → b' (= $b/\sqrt{2\pi}$)?

Same page: just above Eq. No 5.14.

wave overtopping for zero freeboard and derived the following formula (σ' = 0.14), which should be used for probabilistic design and prediction and comparison of measurements (Figure 5.14):

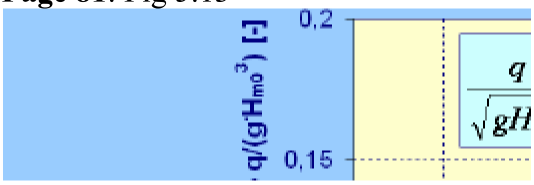
What does σ' mean?

Same page 80: last two lines:

The effect of combined wave run-up and wave overtopping is given by the superposition of overflow and wave overtopping as a rough approximation:

“wave run-up” → “overflow” ??

Page 81: Fig 5.13



Legend to y-axis of Figure 5-13: square root is missing.

Page 83:

$$\gamma_f = 1.15 H_S^{0.5} \text{ for grass and } H_S < 0.75\text{m} \qquad 5.17$$

the subscript to H is capital S; not correct if significant wave height is meant: Hs;
I prefer $\gamma_f = 1.15 \sqrt{H_s}$

Page 85:

$f_h/H_{m0} < 0{,}15 \qquad 5.18$

“$f_h/H_{m0} < 0{,}15$” → “$f_h/H_{m0} < 0.15$”

Page 86: first line: “weighting” → “weighing” ?

Page 87: Equation 5.22

This ratio q_β / q_0 is okay for the Owen’s method. The factor γ_β in the TAW method (refer to Eq 5-5 to 5-11) is part of the exponent; so not linear; maybe an natural logarithm function [ln]?

Page 88:

$$\gamma_\beta = 1 - 0.0033|\beta| \text{ for : } 0° \le \beta \le 80°$$
$$\gamma_\beta = 0.736 \text{ for : } |\beta| > 80° \qquad 5.24$$

This is valid for the TAW method (refer to Equations 5.8 – 5.11).
For Owen's method (refer to Eq 5-12), the following ratio of q_{betha}/q_0 applies:

$$\frac{q_\beta}{q} = 1 - 0.000152\beta^2 \qquad \text{for \textbf{straight} slopes, } 0° \le |\beta| \le 60°$$

$$\frac{q_\beta}{q} = 1.99 - 1.93\sqrt{1.0 - \left(\frac{|\beta| - 60}{69.8}\right)^2} \qquad \text{for \textbf{bermed} slopes, } 0° \le |\beta| \le 60°$$

Page 91:

berm and the still water level (Figure 5.27). The width of the berm B may not be greater than $0.25 \cdot L_0$. If the berm is horizontal, the berm width B is calculated according to Figure 5.27. The lower and the upper slope are extended to draw a horizontal berm

- "L_0". Is the deep-water wavelength meant here? I can't imagine. Seems to be odd, but we have it also in RM. Maybe the fictitious value was also meant here? I.e. $g/(2pi)T^2$?
- "If the berm is horizontal" → "If the berm is <u>not</u> horizontal"
- the terminations of the horizontal arrow indicating the L_{berm} should be shifted slightly.

Page 98:

Table 5.3: Characteristic values for parameter c_2 (TMA-spectra)

Parameter	c_2	σ'

That σ′ is unclear / not defined here. What is TMA spectrum? Where defined/explained?

Same page 98:

$$\frac{\mathrm{v}_\mathrm{A}}{\sqrt{gH_S}} = a_0^* \sqrt{\frac{(R_{u2\%} - \mathrm{z}_\mathrm{A})}{H_S}} \qquad 5.40$$

Unclear why v_A is roman font and g is italicised; the same applies to z_A. "H_S" → "H_s"

Page 100:

$$\frac{\mathrm{h}_\mathrm{C}(\mathrm{x}_\mathrm{C})}{\mathrm{h}_\mathrm{C}(\mathrm{x}_\mathrm{C} = 0)} = \frac{c_2(x_C)}{c_2(x_C = 0)} = \exp\left(-c_3 \frac{\mathrm{x}_\mathrm{C}}{\mathrm{B}_\mathrm{C}}\right) \qquad 5.41$$

Inconsistency in italic font and roman font!

Same page:

= 0.89 for TMA spectra (σ'=0.06) and 1.11 for natural wave spectra (σ'=0.09), and B_C the

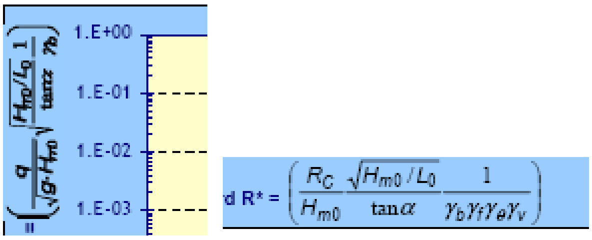
What is σ′?

Page 103:

$$\mathrm{v}_\mathrm{b} = \frac{\quad}{1 + \frac{\mathrm{f}\,\mathrm{v}_{\mathrm{b},0}}{\mathrm{h}_\mathrm{b}\,\mathrm{k}_1}\tanh\left(\frac{\mathrm{k}_1\,\mathrm{t}}{2}\right)} \qquad 5.43$$

By not using italic font for parameters (= variables), thing are getting a bit confused in some cases! This applies to more than this Equation.

Page 106: Figure 5.43:



Why again L_0 here? More straightforward is to use $s_{m-1,0}$ instead of H_{m0}/L_0 [that zero subscript is very confusing; if L is needed then L_o]. The legend to y-axis power 3 is missing at the H_{m0}; legend to x-axis: $\gamma_\theta \rightarrow \gamma_\beta$

Page 108:

Wave run-up has always been less important for rock slopes and rubble mound structures

"rock slopes" → "rock-armoured slopes"

Page 109: what is meant with ξ_0? To read $\xi_{m-1,0}$?

for $\xi_0 \leq 1.8$. From $\xi_{m-1,0} = 1.8$ the roughness factor increases linearly up to 1 for $\xi_{m-1,0} = 10$

Page 110: Eq 6.1 box and Eq 6.2 box:

$\gamma_{f\ surging} = \gamma_f + (\xi_{m-1,0} - 1.8) \cdot (1 - \gamma_f)/8.2$

$\gamma_{f\ surging} = 1.0$ for $\xi_{m-1,0} > 10$.

The symbol for ksi is not correct. This is a zetha [2 times]

Page 112: Fig 6.4

Dimensionless crest height Ac*Dn/Hm02

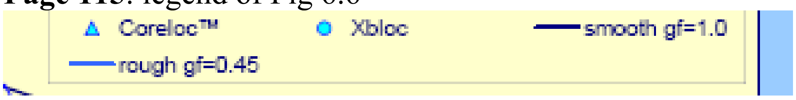
"Hm02 " → "$(H_{m0})^2$ "

Page 114:

As part of the EU research programme CLASH (Bruce *et al.* 2007) tests were undertaken to derive roughness factors for rock slopes and different armour units on sloping permeable structures. Overtopping was measured for a 1:1.5 sloping permeable structure at a reference point $3D_n$ from the crest edge, where D_n is the nominal diameter. The wave

"rock slopes" → "rock-armoured slopes" ; "$3D_n$" → "$3D_{n50}$ " ; "where D_n is the nominal " → "where D_{n50} is the median nominal" [I know that armour units are mentioned, but this way it is correct anyhow; as it was not so clear which typical value to be taken for armourstone]

Page 115: legend of Fig 6.6



"gf= 1.0" → "γ_f = 1.0"

Page 116:

up to $3D_n$. Then the following reduction factor on the overtopping discharge can be applied:

"$3D_n$. " → $3D_n$ (or $3D_{n50}$ for armourstone). "

Page 119:

$$f_{H0} = 19.8 s_{0m}^{-0.5} \exp(-7.08/H_0) \qquad \text{for } T_0 \geq T_0^* \qquad 6.9$$
$$f_{H0} = 0.05 H_0 T_0 + 10.5 \qquad \text{for } T_0 < T_0^*$$

where $H_0 = H_{m0}/\Delta D_{n50}$, $T_0 = (g/D_{n50})^{0.5}\, T_{m0,1}$,
and $T_0^* = \{19.8\, s_{0m}^{-0.5} \exp(-7.08/H_0) - 10.5\}/(0.05\, H_0)$.

"s_{0m}" is used in the Equation; this refers to the mean wave period, but I think we refer to Hm0 and Tm-1,0? So this to read: "$s_{m-1,0}$"? [if not, then at least change the zero into an "o"] There is "$T_{m0,1}$"; is this to read: $T_{m-1,0}$"? If a mean wave period is meant to be used I suggest to make things very clear as the rest of the manual likes to make use of the mean energy wave period. I find it very confusing to read here H_0 with a zero as subscript. There are places where this is the deep-water wave height; therefore, I prefer the notation *Ho* [with an "o" as addition, not as subscript].

Same page 119: Eq 6.11

$$\frac{q}{\left(gH_{m0}^3\right)^{0.5}} = 1.79\times10^{-5}\left(f_{H0}^{1.34} + 9.22\right) s_{op}^{-2.52}\, e^{\left(-5.63\left(\frac{R_c}{H_{m0}}\right)^{0.92} - 0.61\left(\frac{G_c}{H_{m0}}\right)^{1.39} - 0.55 h_{b*}^{1.48}\left(\frac{B}{H_{m0}}\right)^{1.39}\right)} \qquad 6.11$$

- What is h_{b*}? It is not defined in the Notation.
- The "e" of exponent is NOT a variable, so not italic font!

Page 131:

$$h_* = 1.35 \frac{h_s}{\ldots} \frac{2\pi h_s}{\ldots} \qquad 7.1$$

- Pi is not a variable, so not italic font.
- Note that this equation is not the same as the one given in chapter 1;
- Note also that the transitions are not the same as the ones given in ch 1.

Page 133: eq

$$\frac{q}{\sqrt{gH_{m0}^3}} = 0.062 \pm 0.0062 \qquad \text{valid for } R_c/H_{m0} = 0 \qquad 7.5$$

Variables should be italicised. But a zero (as in H_{m0} to be roman font)

Page 134: Figure 7-9 **three** times Hs instead of H_{m0}

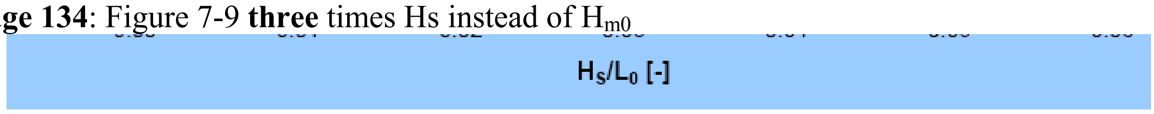


Figure 7.9: Dimensionless overtopping discharge for zero freeboard (Smid, 2001)

Same page 134:

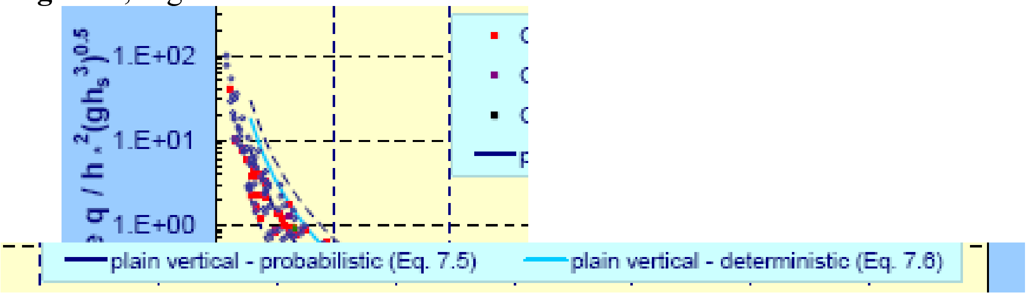
standard deviation of *c.* 0.37 (*i.e. c.* 68% of predictions lie within a range of ×/÷ 2.3).

$$\frac{q}{h_*^2\sqrt{gh_s^3}} = 1.5\times10^{-4}\left(h_*\frac{R_c}{H_{m0}}\right)^{-3.1} \qquad \text{valid over } 0.03 < h_*\frac{R_c}{H_{m0}} < 1.0 \qquad 7.6$$

- errors/mistakes in the line above the equation box;
- Is it really h_s?

The same applies to Eq. 7.7.

Page 135; Fig 7-10:



- Is this really h_s instead of H_{m0}?
- X-refs to equations incorrect.

Same page Line below the Figure:

For R_h < 0.02 arising from h_s reducing to very small depths (as opposed to from small relative freeboards) there is evidence supporting an adjustment downwards of the

What is R_h?

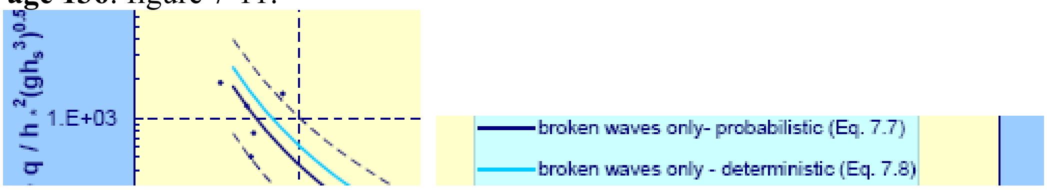
Same page 135: Eq 7-8 and 7-9:

of *c.* 0.15 (*i.e. c.* 68% of predictions lie within a range of ×/÷ 1.4).

$$\frac{q}{h_*^2\sqrt{gh_s^{\,3}}} = 2.7\times10^{-4}\left(h_*\frac{R_c}{H_{m0}}\right)^{-2.7} \quad \text{valid for } h_*\frac{R_c}{H_{m0}} < 0.02\text{; broken waves} \qquad 7.8$$

- errors/mistakes in the line above the equation box;
- Is it really h_s? the same for eq 7-9.

Page 136: figure 7-11:



- Is it really h_s?
- X-refs to equations seem to be wrong

Page 136:

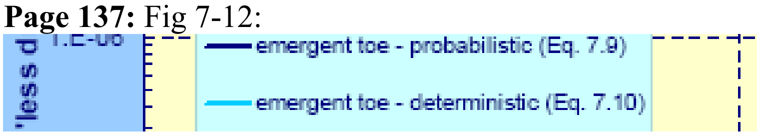
the exponent coefficient (–2.16) is *c.* 0.21.

$$\frac{q}{\sqrt{gH_{m0,deep}^3}}\cdot\sqrt{m s_{m-1,0}} = 0.043\exp\left(-2.16\, m s_{m-1,0}^{0.33}\frac{R_c}{H_{m0,deep}}\right) \qquad 7.10$$

valid for 2.0 < $m s^{0.33}$ $\frac{R_c}{\ldots}$ < 5.0; 0.55 < R/H ... < 1.6;

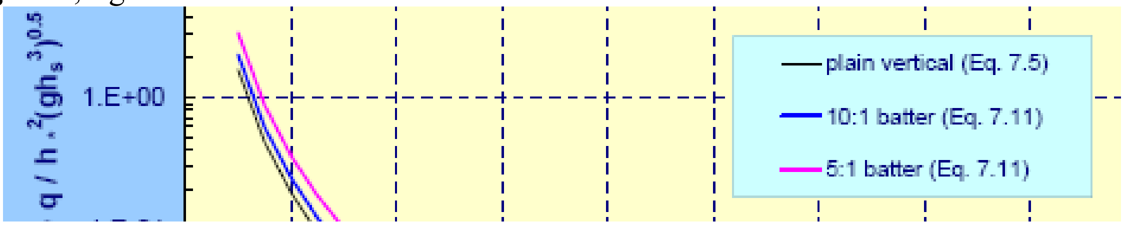
- what is: "*c*. 0.21." ?
- Here $H_{m0,deep}$ to be used. What if there is shallow water (which is mostly the case)?

Page 137: Fig 7-12:



X-refs to equations seem to be incorrect.

Page 138, fig 7-14:



Is it h_s? (iso H_{m0}) – The equation 7-11 gives H_{m0}!

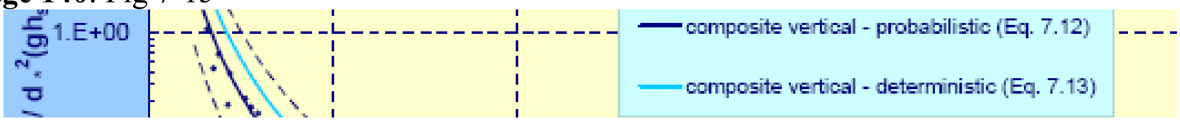
Page 139:

prediction is characterised by a standard deviation of *c.* 0.28 (*i.e. c.* 68% of predictions lie within a range of ×/÷ 1.9).

$$\frac{q}{d_*^2\sqrt{gh_s^3}} = 4.1\times10^{-4}\left(d_*\frac{R_c}{H_{m0}}\right)^{-2.9} \qquad 7.13$$

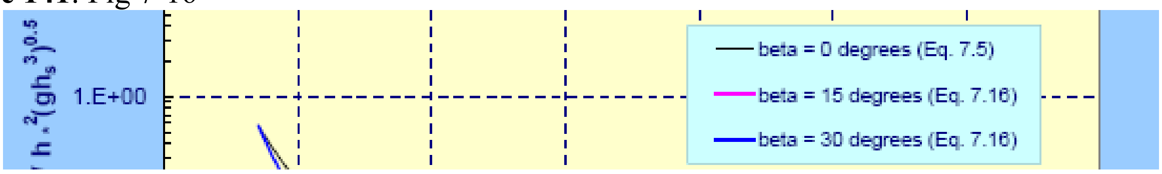
- Text above the Eq box unclear;
- Is it h_s? this also applies to Eq 7-14

Page 140: Fig 7-15



- Is it h_s?
- X-ref to equations to be : "7.12" → 7.13 and 7.13 → 7.14.

Page 141: Fig 7-16



- Again hs ??
- X-ref to Eq 7-16 to read: 7.15. THIS EQ uses H_{m0}!!

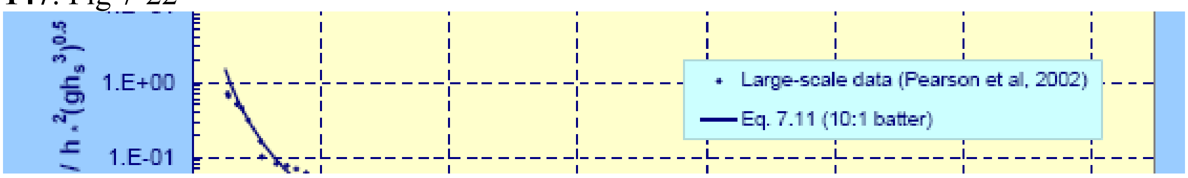
Same P 141: Eq

for $\beta =$ 15° ; $h_*\frac{R_c}{H_{m0}} < 0.2$ as per impulsive $\beta = 0°$ (Eq. 7.6)

for $\beta =$ 30 °; $h_*\frac{R_c}{H_{m0}} \geq 0.07$ $\frac{q}{h_*^2\sqrt{gh_s^3}} = 8.0\times10^{-6}\left(h_*\frac{R_c}{H_{m0}}\right)^{-4.2}$ 7.17

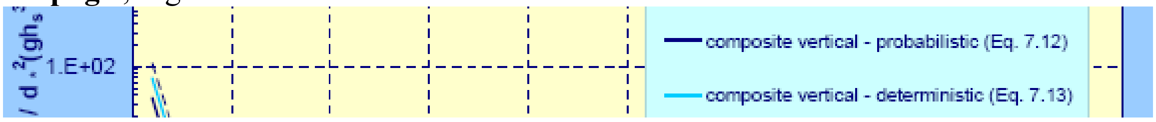
Is this h_s correct?

P 147: Fig 7-22



- Is it hs?
- "Eq 7-11 is no equation, only factors!

Same page , Fig 7-23:



- is this h_s?
- X-refs to read: 7.13 and 7.14 respectively (?)

Page 149:

For *non-impulsive conditions*, there is a weak steepness-dependency for the scale and shape parameters *a* and *b* (Franco (1996);

$$a = \begin{cases} 0.74V_{bar} \\ 0.90V_{bar} \end{cases} \quad b = \begin{cases} 0.66 & \text{for } s_{m-1,0} = 0.02 \\ 0.82 & \text{for } s_{m-1,0} = 0.04 \end{cases} \quad \text{(for } h_* > 0.3\text{)} \qquad 7.28$$

The values of a and b are exactly the same as the ones mentioned in Besley, but then with a different period measure! How can? There we use s_m iso $s_{m-1,0}$!

Page 152:

will land within a distance of $0.25 \times L_o$, where L_o is the offshore (deep water) wavelength.

What to do when we have a case in an estuary? The deep-water wavelength is not relevant!!

Page 158:

s_{0p}	= wave steepness with L_0, based on $T_p = H_{m0}/L_{0p} = 2\pi H_{mo}/(gT^2_p)$	[-]
s_{0m}	= wave steepness with L_0, based on $T_m = H_{m0}/L_{0m} = 2\pi H_{mo}/(gT^2_m)$	[-]
s_0	= wave steepness with L_0, based on $T_{m-1,0} = H_{m0}/L_0 = 2\pi H_{mo}/(gT^2_{m-1,0})$	[-]

These are fictitious wave steepness definitions; so I suggest to make clear that the local value of the wave height is relevant and the fictitious wavelength equal to $g/(2pi)*T^2$. Then also the definition of L_0 to be changed.

-/-
DH