Calculating Tides and Currents

Reference and Secondary Stations

A reference tide or current station is a location at which the tide or current data has been studied over a significant length of time. These are the stations for which daily tables are published by national hydrographic agencies.

Secondary tide and secondary current stations have been studied for a much shorter period of time than the reference stations — sometimes for as little as one month. Most national hydrographic agencies do not publish daily predictions for secondary stations. Instead, they supply a table showing the corrections which must be applied to the times and heights of high or low water or the time and speed of currents. These corrections consist of time differences, height differences, height ratios and speed ratios. If applied properly, the corrections found in the secondary tables provide reasonably accurate approximations for all navigational purposes.

Secondary Tide Calculations (Worksheets 1 and 2)

1. Determine the reference station for the secondary tide station you are interested in. In **Ports and Passes**, the overview tide charts in the front section will indicate the reference station. Then turn to the pages for the reference tide station. A table of corrections for secondary stations accompanies each reference tide station.
2. Determine if the correction factor is a height difference or a height ratio. Most corrections are given as height differences, but some (especially in the US) are given as height ratios. For height differences, use Worksheet 1 (step 3.1). For height ratios, use Worksheet 2 (step 4.1).
3. **Height Difference (Worksheet 1)**
   - 3.1. Enter the times and heights of the tide at the reference station in columns 1 and 2 of Worksheet 1. If the first tide in the day is a low tide, start on the first row of the worksheet; if the first tide is a high tide, begin on the second row.
   - 3.2. In the *Secondary Tide Stations* table, find the time difference for high water. Enter this difference in the HW rows of column 3 of Worksheet 1.
   - 3.3. Find the time difference for low water, following the same process as in 3.2, and enter this difference in the LW rows of column 3.
   - 3.4. Find the height difference for high water in the *Secondary Tide Stations* table and enter this difference in the HW rows of column 4.
   - 3.5. Find the height difference for low water in the *Secondary Tide Stations* table and enter this difference in the LW row of column 4.

3.6. Add (or subtract) the time difference in column 3 to (or from) the time in column 1. **(See Note 1.)** Write your answer on the same row in column 5. Continue until all the rows are complete.
3.7. Add (or subtract) the height difference in column 4 to (or from) the height in column 2. Write your answer on the same row in column 6. Continue until all the rows are complete.
3.8. Columns 5 and 6 are now the time and height of tide for the secondary station.

4. Height Ratio (Worksheet 2)

4.1. Enter the times and heights of the tide at the reference station in columns 1 and 2 of Worksheet 2. If the first tide in the day is a low tide, start on the first row of the worksheet; if the first tide is a high tide, begin on the second row.
4.2. In the *Secondary Tide Stations* table, find the time difference for high water. Enter this difference in the HW rows of column 3 of worksheet 2.
4.3. Find the time difference for low water, following the same process as in 4.2, and enter this difference in the LW rows of column 3.
4.4. Find the height ratio for high water in the *Secondary Tide Stations* table and enter this ratio in the HW rows of column 4.
4.5. Find the height ratio for low water in the *Secondary Tide Stations* table and enter this ratio in the LW rows of column 4.
4.6. Add or (subtract) the time difference in column 3 to (or from) the time in column 1. **(See Note 1.)** Write your answer on the same row in column 5. Continue until all the rows are complete.
4.7. Multiply the height in column 2 by the height ratio in column 4. Write your answer on the same row in column 6. Continue until all the rows are complete.
4.8. Columns 5 and 6 are now the time and height of tide for the secondary station.

Note 1: If the time difference is positive, it means that high water occurs at the secondary station later than the reference station and the time difference must be added to the time in column 1. If the time difference is negative, high water occurs earlier at the secondary station and the time difference must be subtracted from the time in column 1.

Secondary Current Calculations (Worksheet 3)

- "Turn To Flood" (TTF) and "Low Water Slack" have the same meaning.
- "Turn to Ebb" (TTE) and "High Water Slack" have the same meaning.
- “% reference rate” (%ref. rate) and “Speed Ratio” have the same meaning.

1. Determine the reference station for the secondary tide station you are interested in. In Ports and Passes, the overview tide charts in the front section will indicate the reference station. Then turn to the pages for the reference station. A table of corrections for secondary stations accompanies each reference station.
2. Sometimes a "secondary current station" is based on a tide station, not a current station. If the reference station is a current station, proceed directly to step 3.1. If the reference station is a tide station, go to step 4.1.
3. If the Reference Station is a Current Station

3.1. Enter the times of the turns and the maximum speed of the current at the reference station in columns 1 and 2 of Worksheet 3. If the first turn of the day is a TTF, start on the first

row of the worksheet; if the first turn is a TTE, begin on the second row. Ebb currents are normally identified by a "minus" sign (-) or the letter “E”.

3.2. In the *Secondary Tide Stations* table, find the time difference for TTF. Enter this difference in the TTF rows of column 3 of Worksheet 3.

3.3. Find the “% ref. rate” (speed ratio) for the flood current. In some cases, there will be no % ref. rate listed. In that case, you will have to calculate it yourself.

3.4. Enter the “% ref. rate” for the flood current in the TTF rows of column 4.

3.5. Find the time difference for TTE. Enter this difference in the TTE rows of column 3.

3.6. Enter the “% ref. rate” for the ebb current in the TTE rows of column 4.

3.7. Add (or subtract) the time difference in column 3 to (or from) the time in column 1. **(See Note 2.)** Write your answer on the same row in column 5. Continue until all the rows are complete.

3.8. Multiply the maximum speed in column 2 by the "% ref. rate" in column 4. Write your answer on the same row in column 6. Continue until all the rows are complete.

3.9. Columns 5 and 6 are now the times of the turn and the maximum current speed for the secondary station

4. If the Reference Station is a Tide Station

4.1. Find the time of High Water at the Reference Tide Station and enter this time in column 1 of Worksheet 3. If the first tide of the day is a Low Water, begin on the first row; if the first tide is a high water, begin on the second row.

4.2. In the *Secondary Current Stations* table, find the time difference for "Turn to flood". Enter this difference in the TTF rows of column 3 on Worksheet 3.

4.3. Since the current station is based on a tide station, there is no maximum current speed listed at the reference station to be entered in column 2. It is not possible to calculate a "% ref. rate" (speed ratio) to be entered in column 4.

4.4. Add (or subtract) the time difference in column 3 to (or from) the time in column 1. **(See Note 2.)** Write your answer on the same row in column 5. Continue until all the rows are completed.

4.5. Column 5 is now the time of the turn of the current for the secondary station.

4.6. When a secondary current station is based on a reference tide station, it is not possible to know the maximum current speed on any particular flood or ebb. The best that can be done is to estimate an approximate "% ref. rate” (speed ratio) based on the range of the tide at the reference tide station. If it is a mean tide, the maximum current speed at the secondary current station will be moderate. If it is a large tide, the maximum current speed will be close to the maximum listed in the *Secondary Current Stations* table.

Note 2: If the time difference is positive, it means that the turn of the current occurs at the secondary station later than the reference station and the time difference must be added to the time in column 1. If the time difference is negative, the turn of the current occurs earlier at the secondary station and the time difference must be subtracted from the time in column 1.

Worksheet 1

Secondary Tides Calculations (Height difference) (Canada & US)

Reference Station: _____ Date: _____

Secondary Station: _____

	Reference Station		Corrections		Secondary Station	
	Time hr min *Column 1*	Height ft / metres *Column 2*	Time difference hr min *Column 3*	Height* difference ft / metres *Column 4*	Time hr min *Column 5*	Height ft / metres *Column 6*
LW			+ -	+ -	=	=
HW			+ -	+ -	=	=
LW			+ -	+ -	=	=
HW			+ -	+ -	=	=
LW			+ -	+ -	=	=

**(Canada Only) You should normally use the correction for "Mean Tide". Use the "Large Tide" differences only when the tidal range between LW and HW is very large (during spring tides).*

Worksheet 2

Secondary Tides Calculations (Height ratio) (US)

Reference Station: _____ Date: _____

Secondary Station: _____

	Reference Station		Corrections		Secondary Station	
	Time hr min *Column 1*	Height ft / metres *Column 2*	Time difference hr min *Column 3*	Height ratio *Column 4*	Time hr min *Column 5*	Height ft / metres *Column 6*
LW			+ -	x	=	=
HW			+ -	x	=	=
LW			+ -	x	=	=
HW			+ -	x	=	=
LW			+ -	x	=	=

Worksheet 3

Secondary Current Calculation ("Speed ratio" is also called "% ref.rate) (Canada & US)

Reference Station: _____ Date: _____

Secondary Station: _____

	Reference Station		Corrections		Secondary Station	
	Time of Turn hr min *Column 1*	Speed at Max (knots) *Column 2*	Time difference hr min *Column 3*	Speed ratio* (% ref rate) *Column 4*	Time hr min *Column 5*	Speed at Max (knots) *Column 6*
TTF			+ -	x	=	=
TTE			+ -	x	=	=
TTF			+ -	x	=	=
TTE			+ -	x	=	=
TTF			+ -	x	=	=

* *If "% Ref Rate" is not given in the tables, it is determined by dividing the secondary station maximum speed by the maximum speed at the reference station.*

