Secondary Port Calculations

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Standard Port: .... Secondary Port: ....

Date: .... Time Zone*: .... Time / Height Required: ....

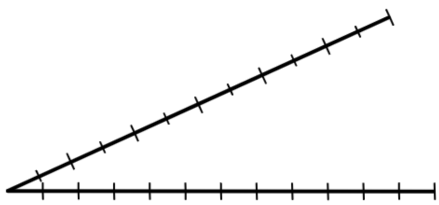
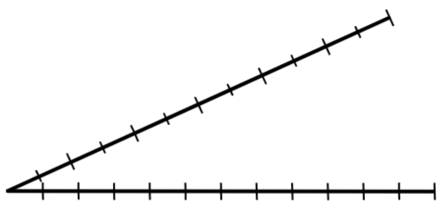
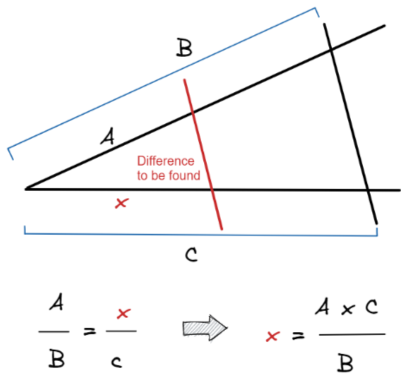
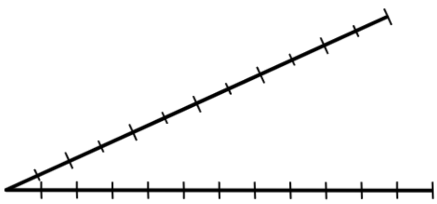
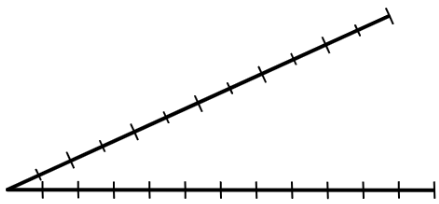
	Time**	Height		
Standard Port	HW or LW***	HW	LW	Tide Range (HW - LW)
	1	2	3	4
Seasonal changes		5	6	
Differences	7	8	9	
Secondary Port	10	11	12	
	Summer Time (DST)			
	13			

* The zone time used for the times is the Standard Time for the port as indicated at the top of each tide table. Tidal differences for the secondary ports are related to the times of HW and LW at the standard port.

** Use the Standard Time of the port as given in the tide table and do **not** add one hour for non-shaded areas.

*** Time for HW if the tidal curve for the standard port is given for HW, otherwise take the LW time.

Interpolation of differences (6-9):

Method 1		Method 2
Time HW or LW 		Thales' theorem 
Height HW 	Height LW 	

Detailed Instructions:

a. From Tidal Tables or a tidal app get the predicted times and Height of High Water (HW) and Low Water (LW) at the Standard Port, and enter them in fields 1 to 3. Note that you only need the time for HW or LW depending on whether the tidal curve for your Standard Port is given for HW or LW.
b. Calculate the tide range (field 4) as the difference between HW and LW heights.
c. If available, apply seasonal change correction to the HW and LW heights in fields 5 to 6.
d. Obtain data for the Secondary Port from the secondary port differences and complete fields 7-9 by interpolation. The interpolations can be resolved graphically using the crocodile graphs or graph paper (Method 1), or mathematically by using Thales' theorem (Method 2).
e. Complete fields 10-12 by applying the differences, and if needed correct the time to the summer time (DST), field 12.
f. On the tidal curve for the Standard Port, plot the HW & LW heights (fields 11-12) and join them with a straight line.
g. Input tide time in the boxes below the tidal curve. From the required time go vertically to cross the tidal curve (neaps – dotted line or springs – solid line).
h. Interpolate between the spring curve and the neap curve if needed based on tide range (field 4). From the curve crossing point go horizontally to cross with f. At the crossing point, go vertically to read off the height of the tide. If you go backward, you can work out the time for the required height of tide.

An alternative to crocodile graphs for Secondary Port interpolations is simple graph paper. The process is identical, except that it utilizes vertical and horizontal axes to work out the differences.

Tidal Stream Calculations

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Standard Port: ....

Date: ....

Springs (Sp) Tide Mean Range* (m): ....

Neaps (Np) Tide Mean Range* (m): ....

Today's HW Time: ....

Today's Tide Range** (m): ....

	Tidal Time	Tidal Time Range	Tidal Set/Direction (°)	Neaps (Np) Tidal Rate (kt)	Springs (Sp) Tidal Rate (kt)	Interpolated Tidal Rate (kt)***
-6						
-5						
-4						
-3						
-2						
-1						
HW		-30min / +30min				
+1						
+2						
+3						
+4						
+5						
+6						

* Mean range for springs and neaps can be read off from the tidal curve of the standard port or from a computation or rates table.
** Difference between HW and LW of standard port for today
*** To interpolate tidal rate use the formula below or the computation of rates table.

$$Interpolated\ tidal\ rate[kt] = \text{Np tidal rate} + (\text{Sp tidal rate} - \text{Np tidal rate})\ \text{x}\ \frac{\text{Today's tide range} - \text{Np Tide Mean Range}}{\text{Sp Tide Mean Range} - \text{Np Tide Mean Range}}$$

$$Simplified\ interpolated\ tidal\ rate[kt] = (\text{Sp tidal rate})\ \text{x}\ \frac{\text{Today's tide range}}{\text{Sp Tide Mean Rang}}$$

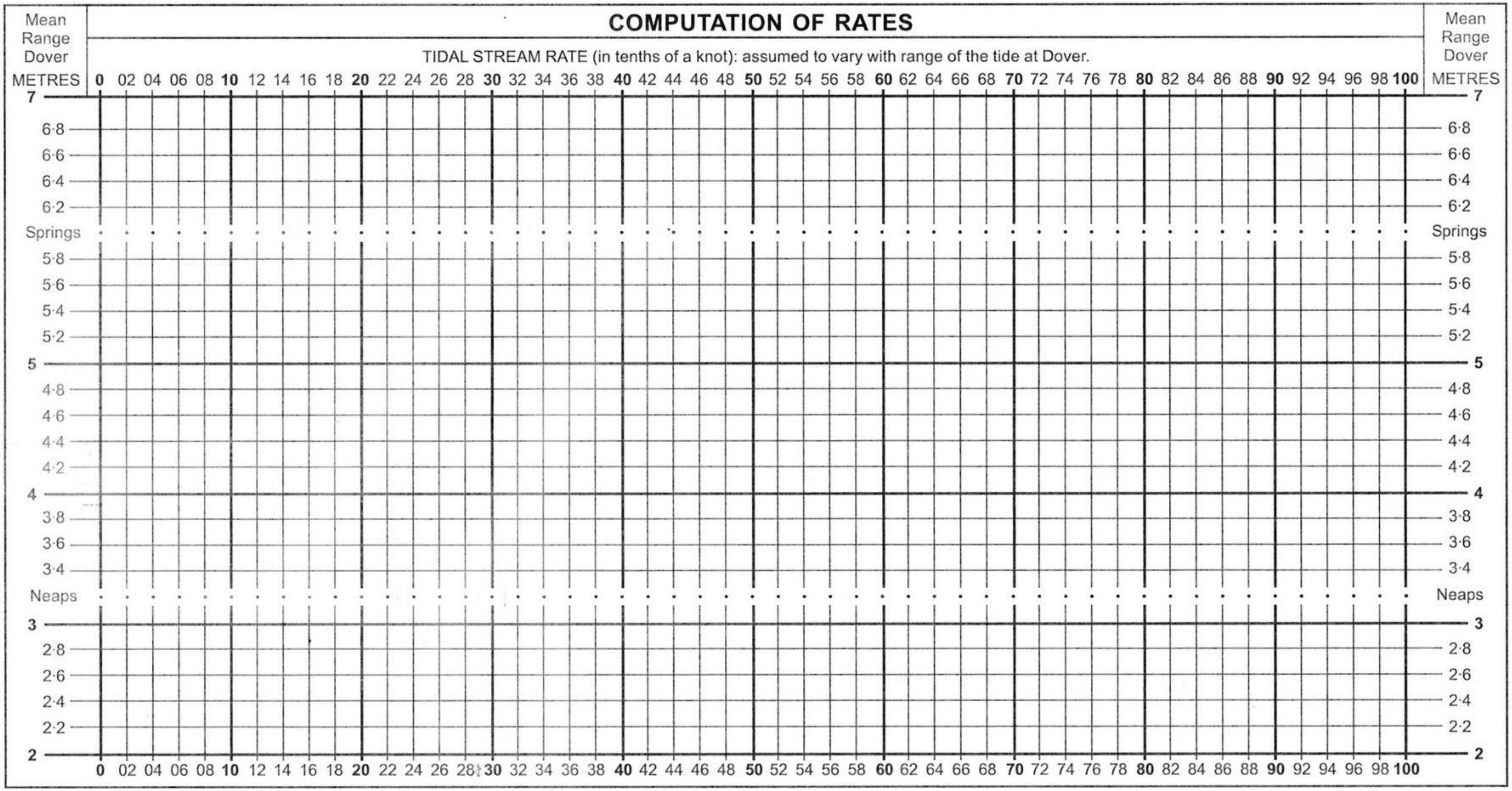

Fig. Computation of Rates diagram from Admiralty Tidal Stream Atlas with (example for Dover as a standard port).
The diagrams are available on the first page of the Admiralty Tidal Stream Atlases.

Instruction for using Computation of Rates diagram:

1. Calculate today's tide mean range at the standard port. Take a difference of all HW and LW and make and average.
2. On the dotted line (representing Springs and Neaps mean range) mark off springs and neaps tidal rates for the given hour and point of interest.
3. Join these 2 points with a ruler. On that line mark off today's tide mean range (point 1) and read off the predicted tidal stream by following the line vertically.

Considerations:

- Tide predictions are computed for a standard barometric pressure of 1013 hectopascals (hPa) or millibars (MB). A difference from the average of 1 hPa can cause a difference in height of 1 centimetre. A low barometer will allow the sea level to rise and a high barometer will tend to depress it.
- Generally, in good weather most of the tidal streams that we encounter should be flowing at a speed that's within 20% of the predicted rate.
- Always leave some safety margin (e.g. 0.5m) under the keel clearance.
- Approaching a narrow entrance of a tidal estuary after a long period of heavy rainfall, be prepared for the ebb tide to be considerably accelerated by floodwater pouring down from the higher ground. The brackish water slips more easily over the denser salt water below it.
- In the open sea around shores, a strong wind blowing continually from the same direction as the tidal stream can increase its speed – and slow it down when it runs towards the blow. As a rough guide, a Force 6 blowing in the same direction for around 12 hours can increase/decrease the tidal stream's speed by about ½ knot, and about 1 ¼ knots if a Force 9 gale persists for a couple of days.
- Stream flows faster in deep water channels. Be aware when crossing a main channel that its deeper water will be flowing much faster than in the shallow water on either side.
- Plan passages to make advantage of wind and tide. Remember that tide is the king in areas of large tidal ranges (1kt of tidal stream translates to about 10kt of wind).
- If possible, go against the tide when approaching a berth or a harbour to have maximum steering control.
- Before entering a complex pilotage situation where accurate allowance for cross-tide is critical, it's worth spending a few minutes holding the station by an outer mark. By stemming the stream while noting the reciprocal of our heading, provided the speed shown on our electronic log is accurate, we can get a fairly reliable indication of the actual speed and direction of the stream we'll encounter when we get underway again.
- You can compute the actual current you are in by comparing your COG and SOG with your speed over water and heading. An accurate digital seawater thermometer is crucial equipment to recognize ocean currents. Surface ocean currents typically have a noticeable temperature contrast with the surrounding water.
- Tide or current going against wind can create very steep and dangerous seas even in otherwise benign weather. The waves are moving forward in the direction the wind is moving, and when they meet a contrary current, they slow down. Their kinetic energy is converted to potential energy and they build in height and shorten in length. You may sometimes do a better progress going against the current and waves but smoother sea.
- When calculating the depth of water, take into account that the height of the tide in mid-Straits (e.g. English Channel) can be up to one metre less than predicted for the adjacent standard port.
- When calculating under water clearance be aware of squat effect. When a vessel is moving through shallow water it creates an area of reduced pressure underneath (Bernoulli effect: more speed, less pressure) that causes the ship to increase its draft. Squat effect is approximately proportional to the square of the speed of the ship. Therefore, by reducing boat speed in shallow water we can reduce squat effect. Squat effect hence reduced under keel clearance may still be experience at anchor, when a strong tide is running across the boat.
- Due to shallow water effect, the vessel may experience reduced speed and be difficult to manoeuvre, and it may be harder to accelerate and deaccelerate her. Therefore, reduce speed in shallow water.
- Similar effect to squat can also be experienced in lateral direction when passing by other large vessels or sailing close to a bank. Therefore, reduce speed in narrow channels. The larger the vessel(s) the more interaction / suction.

Additional resources:

https://bluewatermiles.com/docs/tidal_streams.pdf

https://pzsc.org.uk/shorebased/tidalstreams-ym/