



WA State Marine Pilot Job Task Analysis

Domain 1: Pre-voyage Planning

Pre-voyage Planning consists of preparation for all known parameters relating to a job assignment. Proper planning includes developing a voyage plan considering ship's particulars, tides and currents, weather conditions, suitability of tugs, tanker escort requirements, under keel clearance, and air draft. Pre-voyage planning also considers contingencies, local notice to mariners, state, federal and internal guidelines, route and waterway congestion (recreational and commercial traffic), and wildlife considerations.

Tasks:

1. Plan voyage by reviewing current, tide, weather prediction, and other environmental considerations.
2. Evaluate suitability of assigned tugs by considering type, number, capabilities, escort requirements, limitations, and bollard pull for assigned job.
3. Plan voyage based on potential congestion, other traffic, anticipated vessel characteristics, under keel clearance, air draft, safety considerations, and regulatory requirements and guidelines.
4. Evaluate environmental conditions for docking and undocking.

Knowledge:

1. Knowledge of information contained on pilot orders
2. Knowledge of methods of determining tides and currents
3. Knowledge of effect of environmental conditions on intended route (e.g., height of tide, direction and speed of current, wind, sea state, and visibility)
4. Knowledge of effect of different configurations on handling characteristics
5. Knowledge of type, limitations, and bollard pull/horsepower of available tugs
6. Knowledge of vessels in port
7. Knowledge of vessels underway
8. Knowledge of Local Notice to Mariners
9. Knowledge of vessels at anchor and their locations
10. Knowledge of waterway depths and berth depths
11. Knowledge of minimum under keel clearances
12. Knowledge of procedures for calculating under keel clearance
13. Knowledge of procedures for calculating air draft and overhead clearance
14. Knowledge of effects of salinity on draft of the vessel
15. Knowledge of regulatory requirements and guidelines

Domain 2: Master-Pilot Exchange

The Master-Pilot Exchange concerns the scope and exchange of relevant factors that affect the safe and efficient conduct of a particular pilotage evolution to include discussion of ship's critical equipment and details of the intended



transit. The exchange between the pilot and the master informs and confirms relevant factors and is expected to be an immediate and common information base that is continuously updated and exchanged throughout transit.

Tasks:

1. Confer with master regarding pilot's expectations of bridge team, ship's particulars (pilot card), ship's maneuvering characteristics, and speed change requirements.
2. Confer with master regarding condition of propulsion systems, control systems, navigation systems, anchors, and any limitations or deficiencies.
3. Confer with master regarding number, placement, types of tugs needed, and safe working load (SWL) of ship's deck gear.
4. Confer with master regarding contingency plan.
5. Communicate voyage plan and maneuvering (e.g., docking, anchoring) plan with the master.
6. Communicate relevant regulatory requirements and guidelines.

Knowledge:

1. Knowledge of propulsion and steering systems, including wheelhouse poster
2. Knowledge of capabilities of escort and assist tugs
3. Knowledge of crew duties and bridge procedures when assuming the conn
4. Knowledge of responsibilities to fix position
5. Knowledge of routing, current, environmental conditions, expected traffic, and visibility
6. Knowledge of pilot card information
7. Knowledge of bridge resource management
8. Knowledge of Navigation Rules and Regulations (Rules of the Road)
9. Knowledge of closed loop communication protocols to prevent misunderstandings between pilot and bridge team
10. Knowledge of federal regulations related to minimum equipment requirements
11. Knowledge of regulatory requirements and guidelines

Domain 3: Operational Safety

Safety considerations in pilotage encompass the protection of life, property, and environment. Safe piloting includes evaluation of environmental, operational, and regulatory aspects of the transit and determination of suitable conditions and actions. Conditions and parameters are continuously reevaluated to recognize and prevent errors and make adjustments as appropriate.

Tasks:

1. Evaluate pilot transfer arrangements.
2. Determine if environmental conditions are safe for movement of ship.
3. Identify conditions that may result in an error chain.
4. Comply with fatigue-related regulations for routine operations.

Knowledge:

1. Knowledge of pilot transfer arrangements specified by IMO, SOLAS, US Coast Guard, and IMPA
2. Knowledge of traffic requiring minimum wake
3. Knowledge of effects of fatigue on performance of pilot and crew



4. Knowledge of distractions that may cause lack of situational awareness
5. Knowledge of personal safety practices for embarking and disembarking vessels
6. Knowledge of risk management strategies and their application to maritime pilotage
7. Knowledge of procedures for identifying potential error chain
8. Knowledge of keys to successful error chain breaking in a timely manner

Domain 4: Docking and Undocking

Docking and undocking consists of managing the vessel's inertia, momentum, and overall movement while using available tools including propulsion, rudder, thrusters, and tugs while taking into consideration physical and environmental elements.

Tasks:

1. Plan number and placement of tugs by considering capabilities of thrusters, tug capabilities, weather, current, ship characteristics, berth, and maneuverability required to dock/undock ship.
2. Confer with tugs regarding communication protocol, terminology, tug position and lines, bollard pull, safe working load (SWL) of bitts and chocks on ship, and docking/undocking plans prior to arriving/departing berth.
3. Maneuver vessel, with tugs as needed, to adjust angle of approach depending upon current flow, wind, and sail area.
4. Use tugs to place ship in final position for docking.
5. Use tugs to assist control when undocking.
6. Manage safe speed by considering proximity to other vessels, under keel clearance, weather conditions, and capabilities of tugs in approaching or leaving berth.
7. Monitor speed to safely maneuver ship.
8. Make adjustments for cushion effect, dock condition, and fendering when docking or undocking ship.
9. Anticipate ship's response to propeller rotation when ordering an astern bell.
10. Manage ship's inertia and momentum to determine actions required to manage ship's movements toward or away from berth.
11. Safely execute mooring line operations when docking and undocking.

Knowledge:

1. Knowledge of vessel characteristics (e.g., propulsion, thrusters, type of rudder, engine RPMs, safe working load (SWL) of bitts and chocks, propeller type)
2. Knowledge of berth (e.g., azimuth, depth alongside, currents, tight quarters, fendering, crane height and position)
3. Knowledge of approach and departure maneuvers
4. Knowledge of docking/undocking maneuvers
5. Knowledge of configuration of line placement, line type, and their function
6. Knowledge of effects of speed in confined and shallow waters
7. Knowledge of inertia and its effects when coming alongside
8. Knowledge of effects of hydrodynamics on docking/undocking
9. Knowledge of effects of propeller forces when going ahead or astern
10. Knowledge of effects of sail area on maneuverability of ship
11. Knowledge of effectiveness of thrusters relative to the speed of the vessel
12. Knowledge of amount of bollard pull/horsepower/kW to overcome effects of wind loading
13. Knowledge of sequence of taking lines in or out (e.g., proximity to thruster and propeller)



Domain 5: Anchors

Use of anchors considers relevant factors to successfully bring a vessel to or from anchor, enhance maneuvering, or manage an emergency situation.

Tasks:

1. Assess intended anchorage location for potential hazards.
2. Verify ship's anchored position by using ranges and bearings and other available means.
3. Determine approach angle, speed, and amount of anchor chain needed after considering configuration of the ship, wind/current conditions, depth of water, quality of holding ground, and maneuvering room.
4. Confer with master regarding procedures for dredging anchor.
5. Confer with master regarding procedures for walking out anchor or letting go with the brake.
6. Confer with master regarding condition of anchor windlass.
7. Determine actual position of the anchor when calculating swing radius in the area of other anchored vessels and all other hazards.
8. Use anchors for emergency maneuvers.
9. Determine intended placement of anchor by considering range and bearing and other available means.
10. Assess direction of current, wind, and other external forces on ship's approach to anchoring position.
11. Monitor ship's behavior after anchoring.
12. Maintain safe speed when using an anchor.

Knowledge:

1. Knowledge of natural hazards of anchorages (e.g., depths, obstructions)
2. Knowledge of navigational practices for determining location of anchorage area
3. Knowledge of chart information relative to anchoring
4. Knowledge of regulated or designated anchorages
5. Knowledge of factors to consider in determining scope of chain when anchoring
6. Knowledge of standards of care for vessels at anchor
7. Knowledge of techniques for dredging the anchor
8. Knowledge of ship's anchoring equipment
9. Knowledge of deep-water anchor procedures
10. Knowledge of procedures to anchor in narrow channels
11. Knowledge of emergency use of anchors
12. Knowledge of techniques for using anchors to dock and undock ships
13. Knowledge of anchoring techniques to drop anchor, lay out the scope, set the anchor, and assess where the vessel ends up

Domain 6: Safe Navigation

Navigation for safe piloting applies visual and electronic navigational tools such as radar, AIS, ECDIS, and VHF radio. A pilot uses electronic and visual aids for navigation to ascertain the ship's position, vessel targets, and CPA by parallel indexing, plotting, and visual landmarks. Navigation also involves aids to navigation, ranges, VTS protocol, and knowledge of rules of the road, and local and state regulations.

Tasks:

1. Evaluate traffic conditions in boarding area prior to embarking and disembarking.



2. Obtain information regarding names of vessels by using Automatic Information Systems (AIS), Vessel Traffic Service (VTS), Electronic Chart Display and Information System (ECDIS).
3. Assess information for collision avoidance by using all available means.
4. Identify vessels by their light characteristics at night or day shapes by day.
5. Navigate ship in accordance with applicable Navigation Rules and Regulations.
6. Confirm location in channel based on visual landmarks.
7. Develop radar ranges around transit points, tangents, or fixed marks to determine vessel's location.
8. Establish parallel index lines off points and/or fixed aids to navigation.
9. Verify vessel's position by comparing data from electronic navigational aids with visual observations.
10. Use natural ranges to determine set and drift motion of vessel.
11. Verify commands by visual confirmation, by audible confirmation, and by monitoring ship's equipment to ensure command has been executed.
12. Monitor ship's position by using ranges and bearings from fixed objects and all other available means to determine ship position.
13. Consider configuration of ship, trim, draft, speed, and proximity to shoreline to prevent wake damage.
14. Monitor environmental conditions that affect safe movement of the ship.
15. Monitor appropriate radio channels.
16. Post a lookout or crew member to stand by anchors beyond Navigation Rules and Regulations, navigation requirements, or restrictions.
17. Monitor and amend the voyage plan as safety, scheduling, and changing conditions require.
18. Consider effects of environmental, traffic conditions, and wake effects when establishing safe speed.
19. Calculate Estimated Times of Arrival (ETAs).

Knowledge:

1. Knowledge of Chart One
2. Knowledge of aids to navigation
3. Knowledge of navigational equipment, including the capabilities and potential errors, and techniques for compensating
4. Knowledge of Navigation Rules and Regulations (COLREGS)
5. Knowledge of different methods to assess risk of collision
6. Knowledge of traffic, weather, or environmental conditions that will affect safe navigation of the vessel
7. Knowledge of radar tools to keep safe distances from navigational hazards
8. Knowledge of electronic navigation equipment used in piloting and collision avoidance (e.g., radar, AIS, ECDIS safety contour settings and chart symbols)
9. Knowledge of visual cues to assess fore and aft motion
10. Knowledge of navigating rivers, points, and bends
11. Knowledge of factors that affect estimated time of arrival (ETA) calculations
12. Knowledge of the difference between speed over ground and speed through the water
13. Knowledge of calculations for set and drift
14. Knowledge of engine slowdown procedures
15. Knowledge of VHF radio protocols and bridge-to-bridge communication
16. Knowledge of regulatory requirements related to navigation equipment function and vessel visibility

Domain 7: Shiphandling

Shiphandling involves continuous control, evaluation, and adjustment of a vessel's position and progress considering ship's characteristics, capabilities, environmental factors, and intended route.



Tasks:

1. Evaluate ship's responsiveness when executing maneuvers (e.g., turns, slowing down, speeding up).
2. Consider vessel types and configurations on maneuvering.
3. Assess rate of turn from visual or electronic means.
4. Monitor ship's performance by using visual and all other available means.
5. Adjust amount of rudder as needed to account for pivot point and speed changes.
6. Monitor advance and transfer.
7. Consider effect of current and wind on course over ground versus heading.
8. Determine effectiveness of thrusters by considering speed, trim, and draft.
9. Assess effects of change in pivot point location.
10. Evaluate effect of engine type and propulsion system on maneuverability of ship.
11. Evaluate effect of propeller transverse thrust going ahead and astern.
12. Evaluate effects of different types and size of rudders on handling of ship.
13. Manage effects of pivot point changes with speed (e.g., wind, thrusters).
14. Determine whether ship has positive, negative, or neutral directional stability.
15. Respond effectively to a rudder or propulsion failure.

Knowledge:

1. Knowledge of different vessel types and configurations and their capabilities and limitations
2. Knowledge of rate of turn versus rudder commands
3. Knowledge of vessel response under various loaded conditions and speeds
4. Knowledge of slowdown time and distance necessary for reducing speed
5. Awareness that actual responses may vary from expectations
6. Knowledge of techniques for emergency shiphandling
7. Knowledge of emergency procedures in maneuvering vessel
8. Knowledge of limitations and discrepancies of navigation instrumentation
9. Knowledge of uses of navigational equipment during maneuvering situations
10. Knowledge of ranges and bearings to estimate speed, set, and drift
11. Knowledge of location of pivot point of a vessel underway
12. Knowledge of advance and transfer and the forces that affect it
13. Knowledge of effects of speed, trim, and draft on thrusters
14. Knowledge of effects of water speed and engine speed on rudder control
15. Knowledge of effect of engine types, propellers, and rudders on maneuverability of ship
16. Knowledge of trim and its effect on vessel handling
17. Knowledge of propeller thrust and rudder effectiveness while maneuvering ahead or astern
18. Knowledge of specialized rudders and propulsion systems and their effect on vessel handling
19. Knowledge of effect of turning forces (e.g., rudder, transverse thrust, tug forces, etc.) interactive forces, and forces of wind and tide on position of pivot point
20. Knowledge of effects of loading on vessel's handling
21. Knowledge of effects of rudder actions on directional rotation
22. Knowledge of directional stability
23. Knowledge of techniques and effects of rudder cycling on ship's speed

Domain 8: Restricted Waterway Transit

A restricted waterway is a narrow area that may contain docks or obstructions on one or both sides. Restricted waterway transit consists of managing the overall movement and position of the vessel in the waterway while compensating for the effects of hydrodynamics, environmental conditions, and nearby vessels.



Tasks:

1. Evaluate effects of moored vessels in waterway by considering their blockage factor and wind shadow.
2. Compensate for effects of currents and weather on maneuverability of ship.
3. Consider sail area, moored vessels, hydrodynamic forces, swept path, and effective use of tugs during waterway transit.
4. Counter effect of bank cushion, bank suction, and squat in shallow waterways.
5. Manage vessel heading in a narrow waterway to avoid excessive changes in ship's profile as related to swept path.
6. Manage effects of speed on moored vessels.
7. Maneuver vessel in and out of locks.
8. Manage vessel speed to effectively control the ship.

Knowledge:

1. Knowledge of techniques to maneuver ships in narrow channels
2. Knowledge of effects of predicted depth versus observed depth of water (e.g., barometric pressure, water level, river flow, reported shoaling)
3. Knowledge of vessel's draft and squat in relation to speed and depth of water
4. Knowledge of effects of wind and/or visibility on ability to maneuver in waterway
5. Knowledge of visual cues to assess current
6. Knowledge of visual cues to assess wind
7. Knowledge of safe speed to proceed through waterway
8. Knowledge of waterway dimensions and width of horizontal clearance when calculating available room to navigate vessel
9. Knowledge of maneuvering in turning basins
10. Knowledge of turning forces (e.g., bank cushion, bank suction, wind forces) in shallow waterways
11. Knowledge of the effects of shallow water on vessel maneuverability
12. Knowledge of hydrodynamic effects of a vessel in or approaching/departing a lock
13. Knowledge of methods to determine swept path
14. Knowledge of techniques necessary to maintain safe position while minimizing swept path
15. Knowledge of bridge signaling methods and requirements for opening

Domain 9: Tugs

Use of tugs involves general knowledge of tug types, capabilities, and limitations, various escort techniques for tethered and untethered transit, the safe positioning of the tugs, and establishing and maintaining effective communication with tugs.

Tasks:

1. Operate the vessel in compliance with regulations pertaining to escorts.
2. Maintain safe positioning for tugs (e.g., proximity to anchors, mooring lines, obstructions).
3. Adjust tug forces to account for change in pivot point.
4. Establish and maintain effective communication with tugs.
5. Position and use tugs in a safe and effective manner.



Knowledge:

1. Knowledge of different types of tugs (e.g., conventional, Z-drive, voith) and their capabilities and limitations
2. Knowledge of tug escort techniques for tethered and untethered transit
3. Knowledge of emergency maneuvering techniques using tugs
4. Knowledge of escort regulations and guidelines
5. Knowledge of vessel speed on tug effectiveness
6. Knowledge of differences between horsepower and bollard pull as applied to tugs
7. Knowledge of tug-ship interaction
8. Knowledge of tug maneuvering levers
9. Knowledge of basic tug positions for ship work
10. Knowledge of dead ship towing techniques