TRAINING MODULE

Standard Work Combination Sheet

The one document that shows the RHYTHM, not just the steps

A working module for engineers with 1–2 years on the floor. By the end you will be able to classify any element into Manual/Walk/Auto, correct it to per-piece time, and build a combination bar against Takt by hand.

Grounded in the Toyota Production System's three elements of Standard Work: Takt Time, Work Sequence, and Standard WIP

BEFORE WE START

What You Will Be Able to Do After This Module

1. Explain what SWCS shows that SOP, OPL, and OCP each individually do not.
2. Classify any element into Manual, Walk, or Auto — the same rule the tool uses.
3. Correct a batch cycle time to per-piece time using the shot-quantity formula.
4. Build a station's combination bar by hand, laid end to end against Takt.
5. Recognize the two most common mistakes junior IEs make when they first read a combination sheet.

Four Documents, Four Different Jobs

Document	What It Uniquely Shows
SOP	The STEPS — what to do, in order.
OPL	ONE POINT — a single critical knack or quality risk, taught in isolation.
OCP	What's CONTROLLED — which characteristics get checked, how, how often.
SWCS (this tool)	**The TIMED RHYTHM — how the cycle's Manual, Walk, and Auto time lay against Takt, in one picture.**

None of the other three tell you whether the cycle actually FITS inside Takt, or which specific piece of it doesn't. That's this tool's job alone.

THE CORE IDEA

Every Element Is Manual, Walk, or Auto — Nothing Else

Lay them end to end for one station and Takt either fits, or it visibly doesn't:

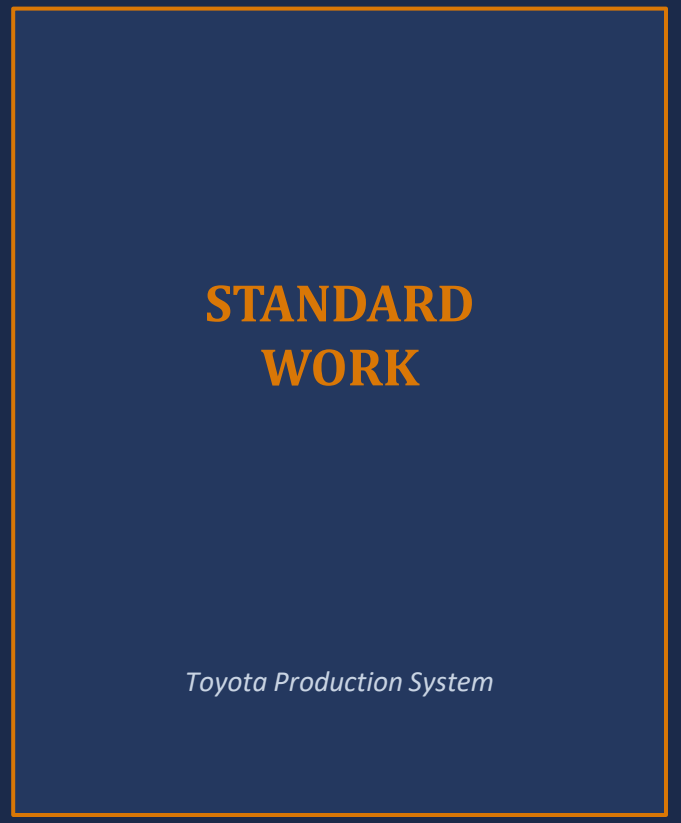
MANUAL	Operator hands doing something — grasp, position, use, inspect, hold, release.
WALK	Operator transporting, empty-handed or loaded — moving between positions.
AUTO	Machine running its own cycle — the operator is not the constraint here.

WHERE THIS METHOD COMES FROM

Three Elements, One Table

TPS defines Standard Work as exactly three elements working together: Takt Time (the pace), Work Sequence (the order), and Standard WIP (the minimum in-process inventory needed to run the sequence without stopping). The Standard Work Combination Table is the one document built to show all three at once — which is exactly why this tool carries a Standard WIP marker between stations, not just a Takt line.

Miss any one of the three and it isn't Standard Work — it's just a schedule.



THE THREE ELEMENTS, EACH ON THIS SHEET

Takt Time, Work Sequence, Standard WIP

TAKT TIME

The vertical reference line every combination bar is measured against — already familiar from the Bottleneck module.

Where on the sheet: the reference column, drawn once, shared by the whole Line View.

WORK SEQUENCE

The order Manual/Walk/Auto segments actually run in — not a reshuffled ideal, the real recorded order.

Where on the sheet: left-to-right order of the combination bar itself.

STANDARD WIP

The minimum parts sitting between stations so the sequence can run without waiting on its neighbor.

Where on the sheet: the WIP marker drawn between each pair of stations in Line View.

THE METHOD, IN ONE PICTURE

Three Steps, Always in This Order

1

CLASSIFY

Every element into exactly one bucket: WALK, AUTO, or MANUAL.

2

CORRECT

Normalize to PER-PIECE time — divide by shot quantity where it's greater than 1.

3

COMBINE

Lay segments end to end against Takt — Line View for the whole line, detail view per station.

The rest of this module walks all three steps with ONE worked station.

1

STEP 1

Classify Every Element

Reuses man_gantt_mtm.py's own map_therblig() classifier for WALK — never a second, differently-worded rule.

Auto is decided by data, not description: mc_ct > 0 means the machine, not the operator, is running the clock.

SIX RAW ELEMENTS, CLASSIFIED

Element	Description	Rule Applied	Bucket
E1	Grasp part, position in fixture	op_ct > 0, not travel	MANUAL
E2	Walk to machine, part in hand	“walk to” → Transport Loaded	WALK
E3	Machine auto-cycle runs	mc_ct > 0	AUTO
E4	Inspect finished part, release	op_ct > 0, not travel	MANUAL

Notice E2 got WALK not because the word “walk” appears literally, but because the classifier recognizes the transport pattern — same logic whether it says “walk to,” “travel to,” or “carry to.”

2

STEP 2

Correct to Per-Piece Time

A batch station's raw cycle time is a BATCH number. Comparing it to Takt without correcting first is comparing the wrong things.

Uses the exact same shot_qty handling as ie_common.read_master() — this sheet never disagrees with the rest of the suite.

WORKED EXAMPLE — A 3-UP FIXTURE STATION

Shot Quantity	Batch Cycle Time	Takt (per piece)
3 parts / cycle	90 seconds	32 seconds

Per-Piece CT = Batch Cycle Time ÷ Shot Quantity = 90 ÷ 3 = 30 seconds

30s per piece vs. 32s Takt — UNDER Takt, with 2s margin. Compared raw (90s batch vs. 32s Takt) it would have looked wildly, falsely overloaded.

WHY THIS MISTAKE IS EASY TO MAKE

A stopwatch on a batch station naturally times the WHOLE batch cycle — nothing about the reading itself warns you it needs dividing. The correction has to be a deliberate step, every time.

STEP 3 — COMBINE

Lay the Segments End to End Against Takt

8 + 3 + 15 + 4 = 30s total, matching the per-piece CT from Step 2 exactly — the combination bar is a cross-check, not a new number.

READING THE PICTURE

15 of this station's 30 seconds is AUTO — machine time the operator can't compress by working harder. If this station ever needs to shrink further, the Manual and Walk segments are where a Kaizen or ECRS review should look first.

TWO VIEWS, TWO AUDIENCES

Line View vs. Per-Station Detail

LINE VIEW

- One horizontal bar PER STATION, all stations stacked in build order
- Single shared Takt reference column across the whole line
- Standard WIP marker shown between stations
- Audience: the whole-line walk, a plant manager's first look

PER-STATION DETAIL

- Element-level bar for ONE station only
- Same three colors, traced back to exact element and description
- Used to defend or investigate one station's number
- Audience: the engineer diagnosing that specific station

BEFORE YOU GO TO THE FLOOR

Five Mistakes That Give Junior IEs Away

✗ Comparing a batch station's raw cycle time to Takt without the per-piece correction — makes a fine station look overloaded, or worse, hides a real problem.

✗ Trying to compress Auto time by pushing the operator — the machine sets that pace, not the person.

✗ Reading only the Line View and never drilling into a Per-Station Detail sheet for the station that's actually tight.

✗ Forgetting the Standard WIP marker — a combination bar that fits Takt can still fail without the right WIP buffer between stations.

✗ Misclassifying a Walk element as Manual because the operator's hands are doing something WHILE walking — the transport pattern still governs the bucket.

FROM PENCIL-AND-PAPER TO THE SOFTWARE

What generate_swcs.py Does For You

Every station's combination bar, classified, corrected, and combined automatically — in both views.

1	**Classifies every element automatically**	Reuses man_gantt_mtm.py's map_therblig() for WALK, and mc_ct > 0 for AUTO — the Step 1 rule, applied to every element on the line.
2	**Corrects to per-piece time automatically**	The same shot_qty handling as ie_common.read_master() — the Step 2 math, so this sheet never disagrees with the rest of the suite.
3	**Builds the LINE VIEW**	Every station's bar stacked in build order, one shared Takt column, Standard WIP marker between each pair.
4	**Builds one SWCS_<station> detail sheet per station**	Element-level bars for drilling into exactly which station needs the Kaizen or ECRS look.

KEY TAKEAWAYS

Recap — Say This Back In Your Own Words

- SOP, OPL, and OCP each show one thing. Only SWCS shows the timed RHYTHM against Takt.
- Every element is Manual, Walk, or Auto — nothing else, and the rule is data-driven, not a guess.
- A batch station's cycle time must be corrected to per-piece before it means anything against Takt.
- Standard Work is three elements together — Takt, Work Sequence, AND Standard WIP. Miss one and it's just a schedule.

TALK IT THROUGH — 3 QUESTIONS FOR YOUR NEXT LINE WALK

1. Pick one batch station on your line — has anyone actually applied the per-piece correction to it, or is its Takt comparison silently wrong?
2. For your tightest station, how many of its seconds are Auto — time no amount of operator effort can compress?
3. Where's the Standard WIP marker for your line, and is it actually the minimum needed — or just “what's always been there”?