Redesignation of Taxiways at Singapore Changi Airport

ICAO Aerodromes Operations and Planning Sub-Group meeting

June 2022

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Outline of presentation

- Review of overall taxiway naming scheme
- Implementation planning
- Managing the transition

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Review of overall taxiway naming scheme

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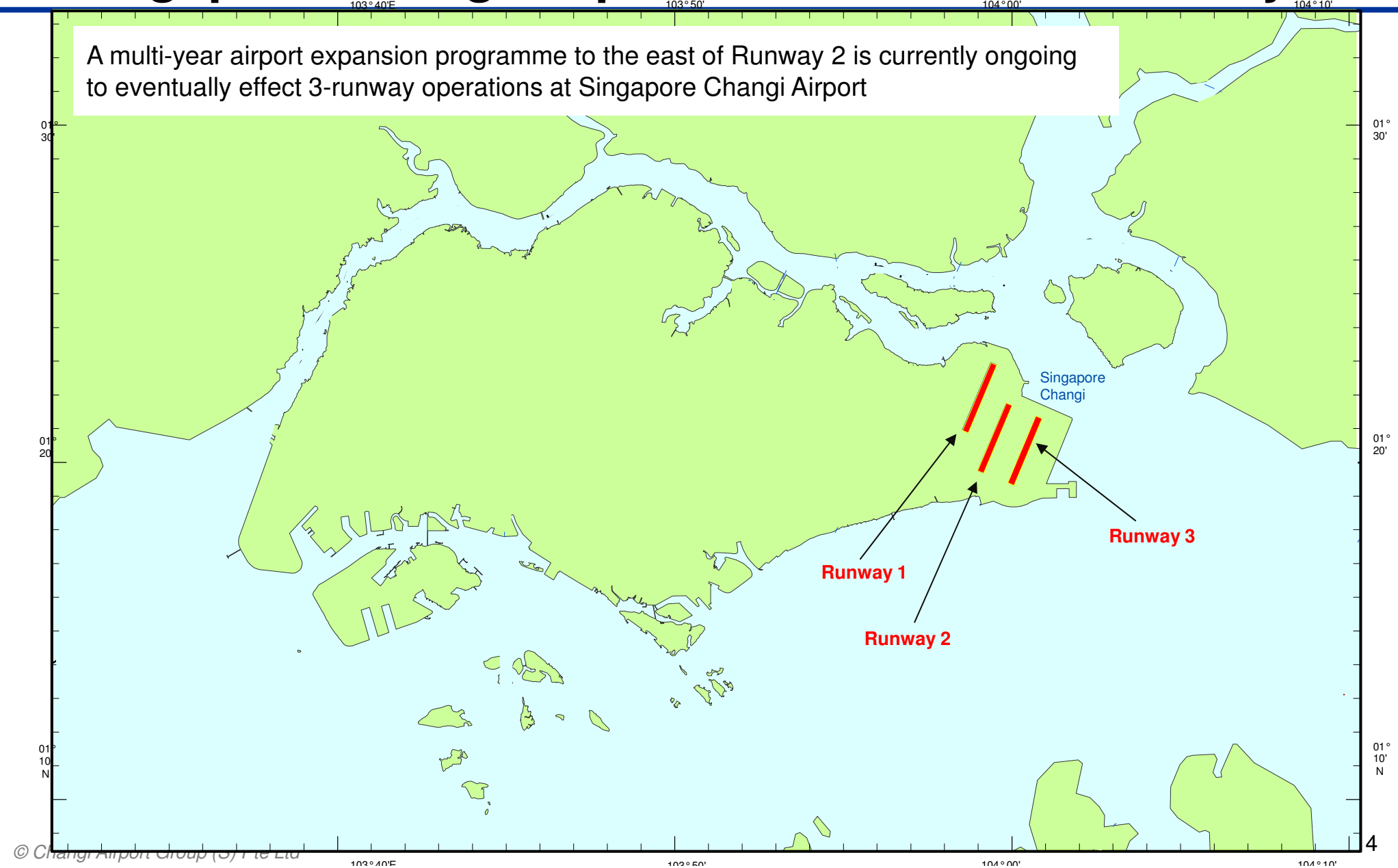
Singapore Changi Airport – Location and Runways



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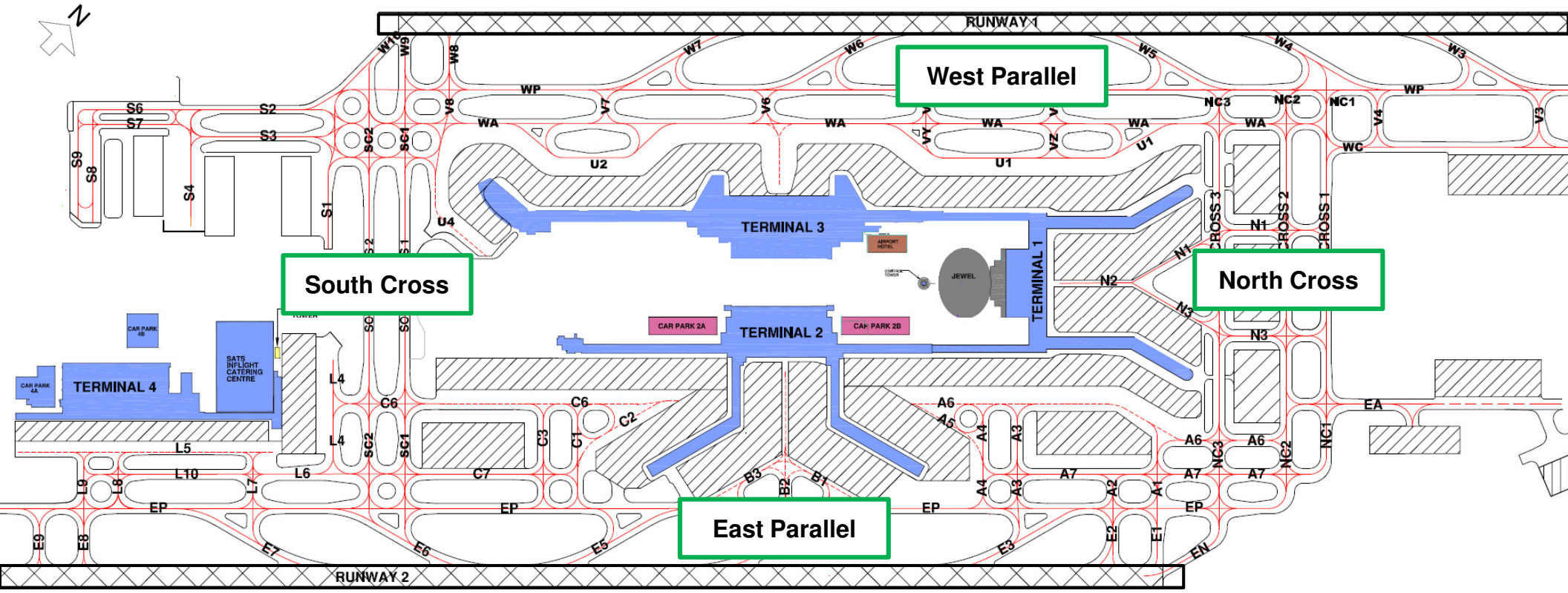
Old taxiway names at Singapore Changi Airport



Existing Taxiways
Letters used:
(exclude I,O,M,X)
A B C D **E**
F G H J K
L N P Q R **S**
T **U V W** Y Z

- Old taxiway naming scheme was generally based on compass directions for the airfield bounded by the Runway 1 (02L/20R) and Runway 2 (02C/20C)

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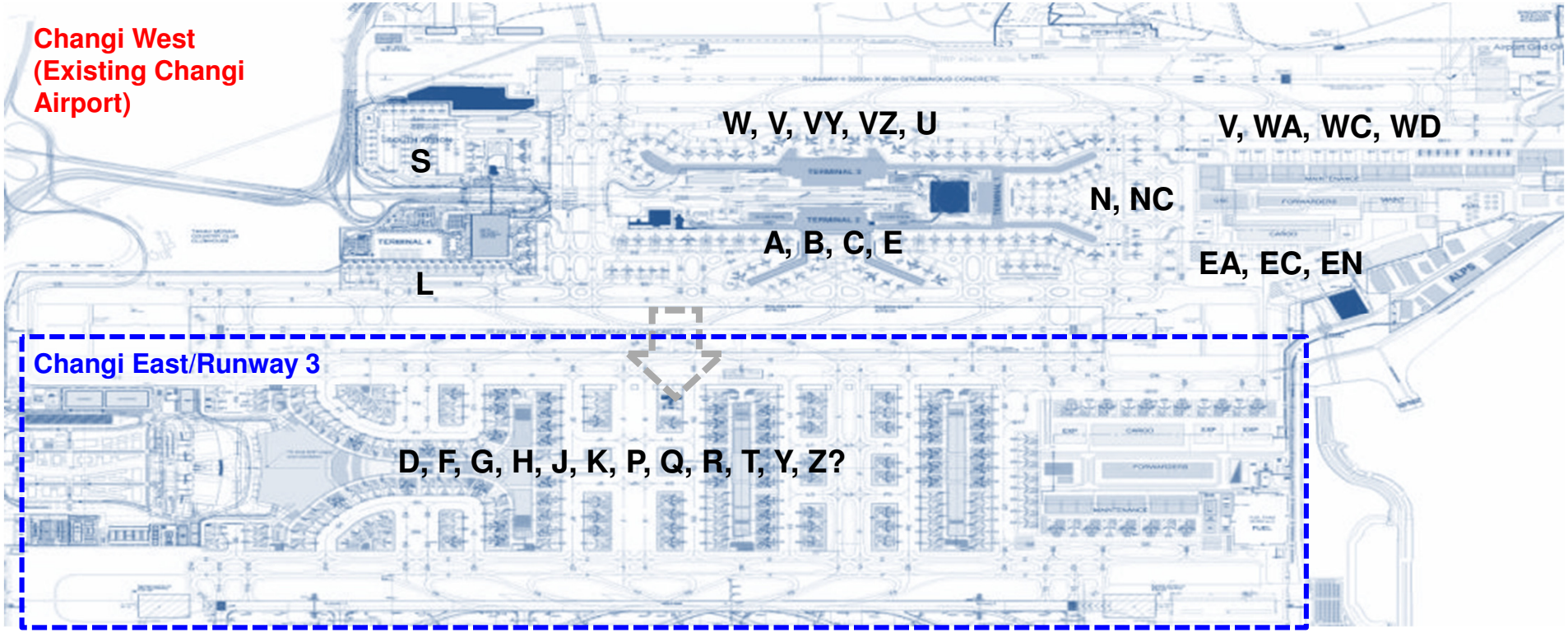
Need logical, sequential naming to navigate expanded airfield layout with new airfield developments at Changi East coming onboard

- Old taxiway names at Singapore Changi Airport was progressively changed from 2019 to 2021 so as to:
  - ✓ Have a coherent taxiway naming scheme for current and future expanded aerodrome (Changi East)
  - ✓ Adopt international best practices
  - ✓ Comply with ICAO Annex 14's Amendment 15 and ICAO Doc 9157 Part 4 relating to taxiway designations
- The new taxiway naming scheme was jointly developed by the aerodrome operator, in consultation with Civil Aviation Authority of Singapore (CAAS) (Regulator and ANSP), pilots and ground service providers



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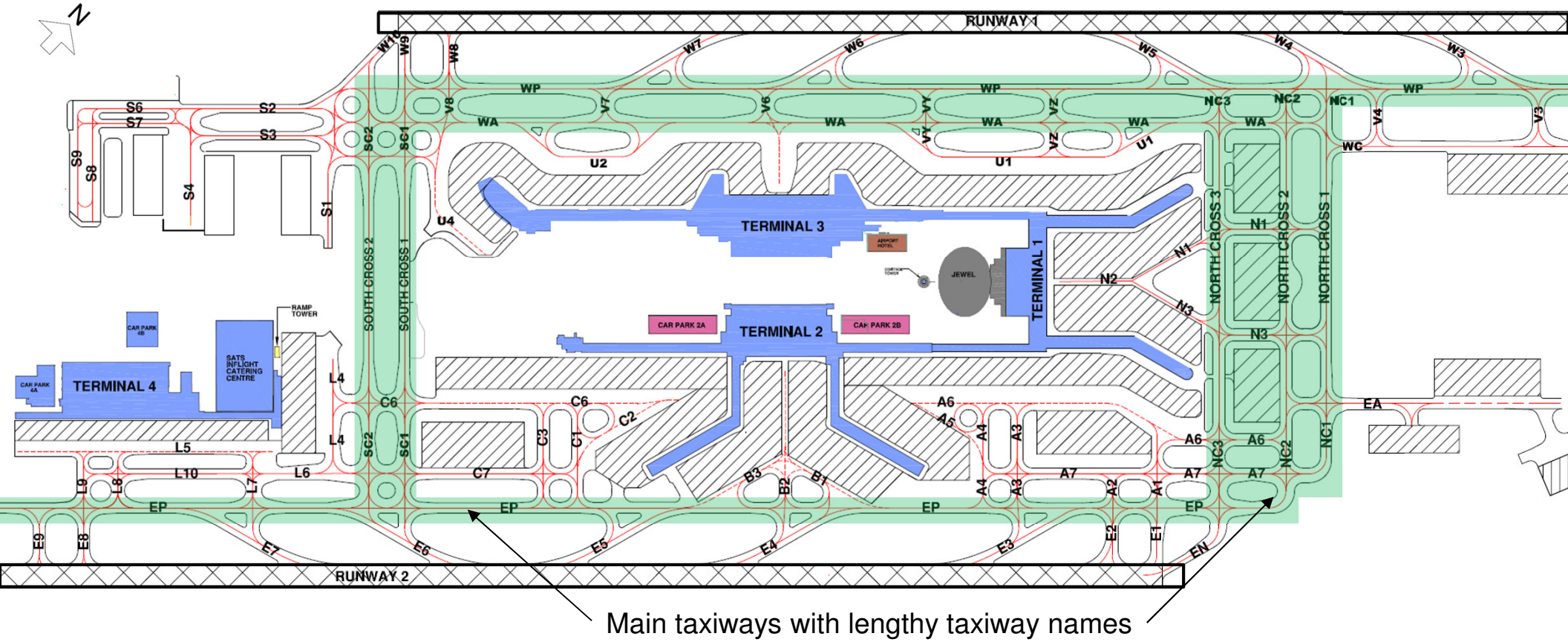
Users prefer to reduce the lengthy taxiway names

- Existing double-letter taxiway designations result in lengthy taxiing instructions, e.g. NC1/2/3, SC1/2, WP, WA, WC, WD, EP, EA, EC, EN, VY, VZ
- Lengthy taxiing instructions increases memory load on pilots, read-back errors, and controllers' workload.



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References studied on principles for naming of taxiways

The new taxiway designation scheme considers the following guidelines:

- ICAO Annex 14, Aerodromes Vol. I – Aerodrome Design & Operations
- FAA Engineering Brief No. 89 – Taxiway Nomenclature Convention
- IFALPA Runway Safety Manual
- IFALPA Technical Manual Annex 14, Volume I
- FAA Advisory Circular (AC) No.: 150/5340-18F - Standards for Airport Sign Systems
- ACI Runway Safety Handbook
- *ICAO Doc 9157 Part 4*

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ICAO Annex 14 Vol. 1 (2020)

5.4.3.35 A taxiway shall be identified by a designator that is used only once on an aerodrome comprising a single letter, two letters or a combination of a letter or letters followed by a number.

5.4.3.36 Recommendation.— *When designating taxiways, the use of words such as "inner" and "outer" should be avoided where possible.*

5.4.3.37 When designating taxiways, the use of the letters I, O or X shall not be used to avoid confusion with the numerals 1, 0 and closed marking.

5.4.3.38 The use of numbers alone on the manoeuvring area[1] shall be reserved for the designation of runways.

5.4.3.39 Recommendation. – *Apron stand designators should not be the same as taxiway designators.*

[1] *Manoeuvring area. That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons*

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International recommended guidelines and best practices on airside designations

	Principle
1	The assignment of letters for the designation of taxiways should start at one end of the aerodrome and follow a consistent sequence to the opposite end. e.g. east to west or north to south. For aerodromes with a number of taxiways exceeding the number of available letters, double-same letters may be used. e.g. AA, BB.
2	Taxiways serving primary traffic routes should be restricted to one letter only. E.g. A (alpha), B (bravo), C (charlie).
3	The letters I (India), O (Oscar) and X (X-ray) and words such as inner and outer shall not to be used as they could be mistaken with the numbers 1, 0 and a closed marking.
4	Different taxiways on the same aerodrome shall not have the same designators.
5	Those taxiways that connect to the runway should have an alpha numeric designation (e.g. A1, A2, A3...A12). The numbering should start from the number one (1) at one end of the runway and follow a consistent sequence to the other end (e.g. not omitting numbers or “jumping” back and forth in numbering).
6	Taxiways that serve as connectors to an apron may also use the alpha numeric designators in consistent sequence.
7	Taxiways crossing a runway should be avoided, where this is not possible, the taxiways should have different names on each side of the runway.
8	Apron stand designators should be unique from other designators at the aerodrome.

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The new taxiway naming scheme was extensively deliberated with stakeholders

- Important to ensure that the airfield users are aligned on the need to change, and jointly agree on the new taxiway naming scheme to be adopted.

- Extensive stakeholders workshops were conducted to discuss issues of:
  - Taxiway naming principles
  - Numerical order of taxiways
  - Balancing of different user preferences
  - Feasibility of implementation

- Netherlands Airport Consultants (NACO) was appointed to assist the review, refine the plans and carry out a risk study on the taxiway naming scheme.

- The entire review was completed in about a year after many rounds of iteration with stakeholders, including pilots, air traffic controllers and ground service providers.

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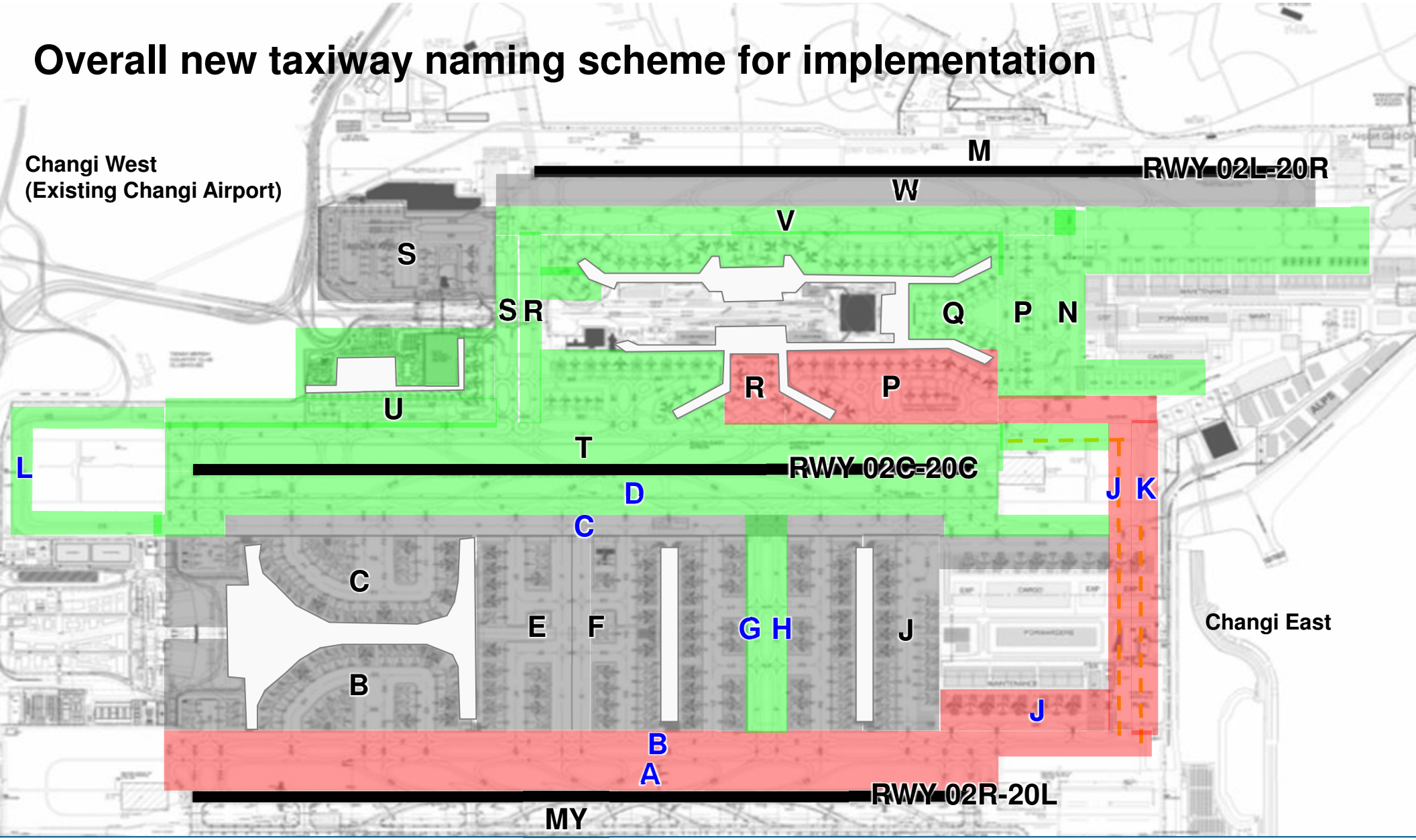
Overall new taxiway naming scheme for implementation



Letters A to L are used for Changi East taxiways
Letters N to Z are used for Changi West taxiways
Letters I, O, X are not used
Letters Y and Z are reserved for future use

Key features of this taxiway naming scheme:

1. Taxiway naming are logical and sequential.
2. Implementation plan - Removes existing conflict of stands and taxiway names, without generating more conflicts during transition.

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Implementation

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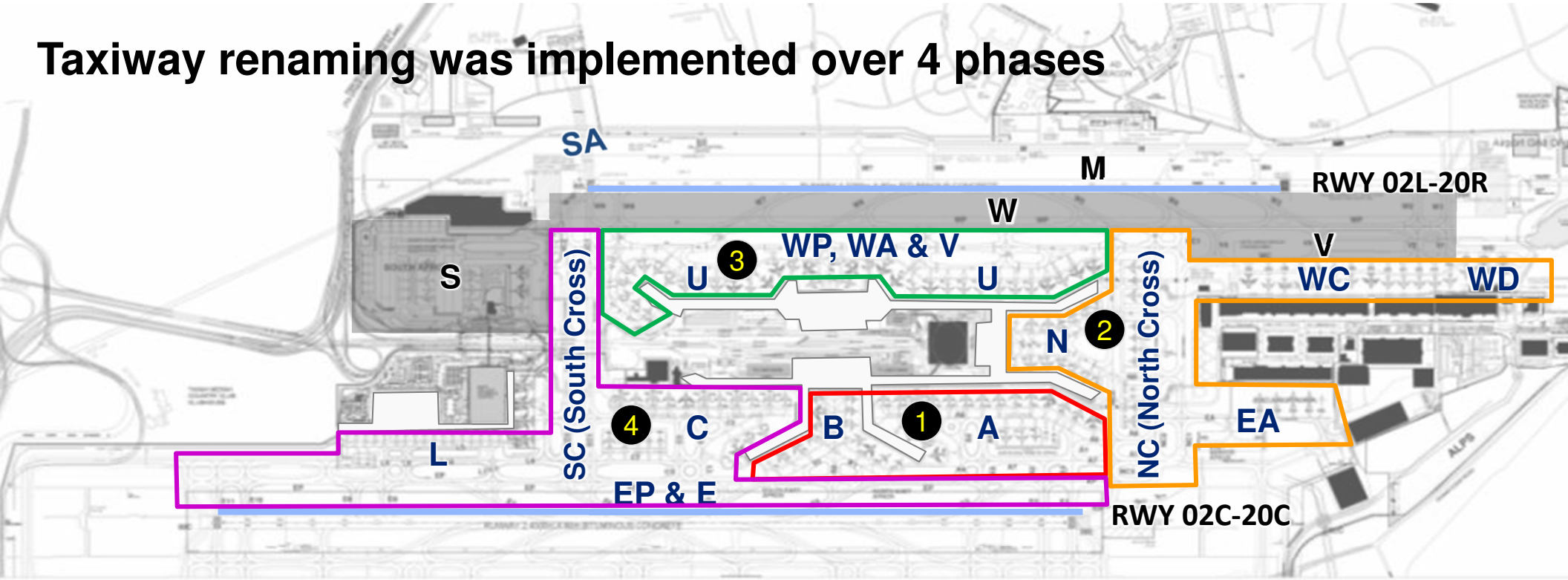
Taxiway renaming was implemented over 4 phases



Implementation Dates 1 July 2019 2 March 2020 3 August 2020 4 May 2021

- Implementation phasing was planned to coincide with the replacement of airfield guidance signs that are nearing end of life; and interfaced with the commissioning of new taxiways as part of Runway 3 works.
- Extent of each phase also considered the available resources to effect the airfield guidance sign changes during airport lull period to minimise the impact on operations.

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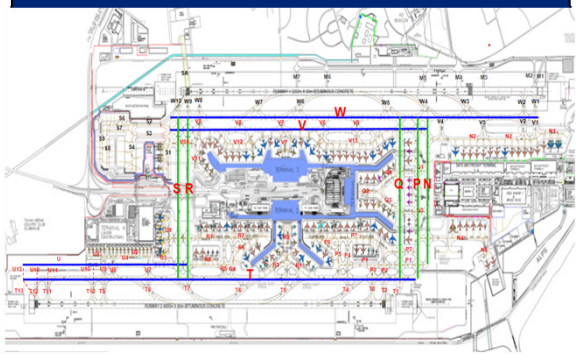
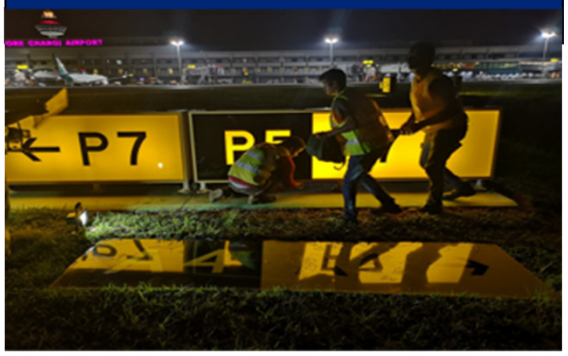
The safety framework spanned across planning the taxiway designations through construction works to operations post-change

(1)
Planning & Design
Risk Assessment



(2)
Construction
Risk Assessment



(3)
Operations
Risk Assessment

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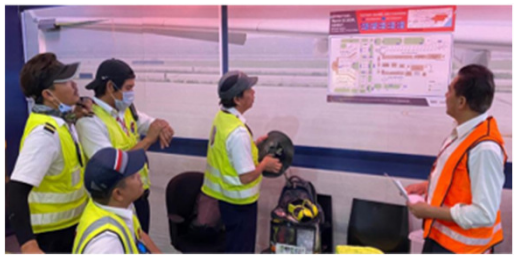
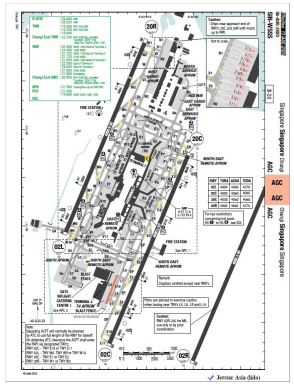
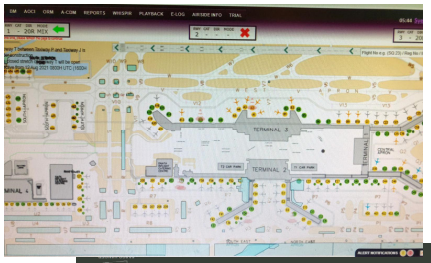
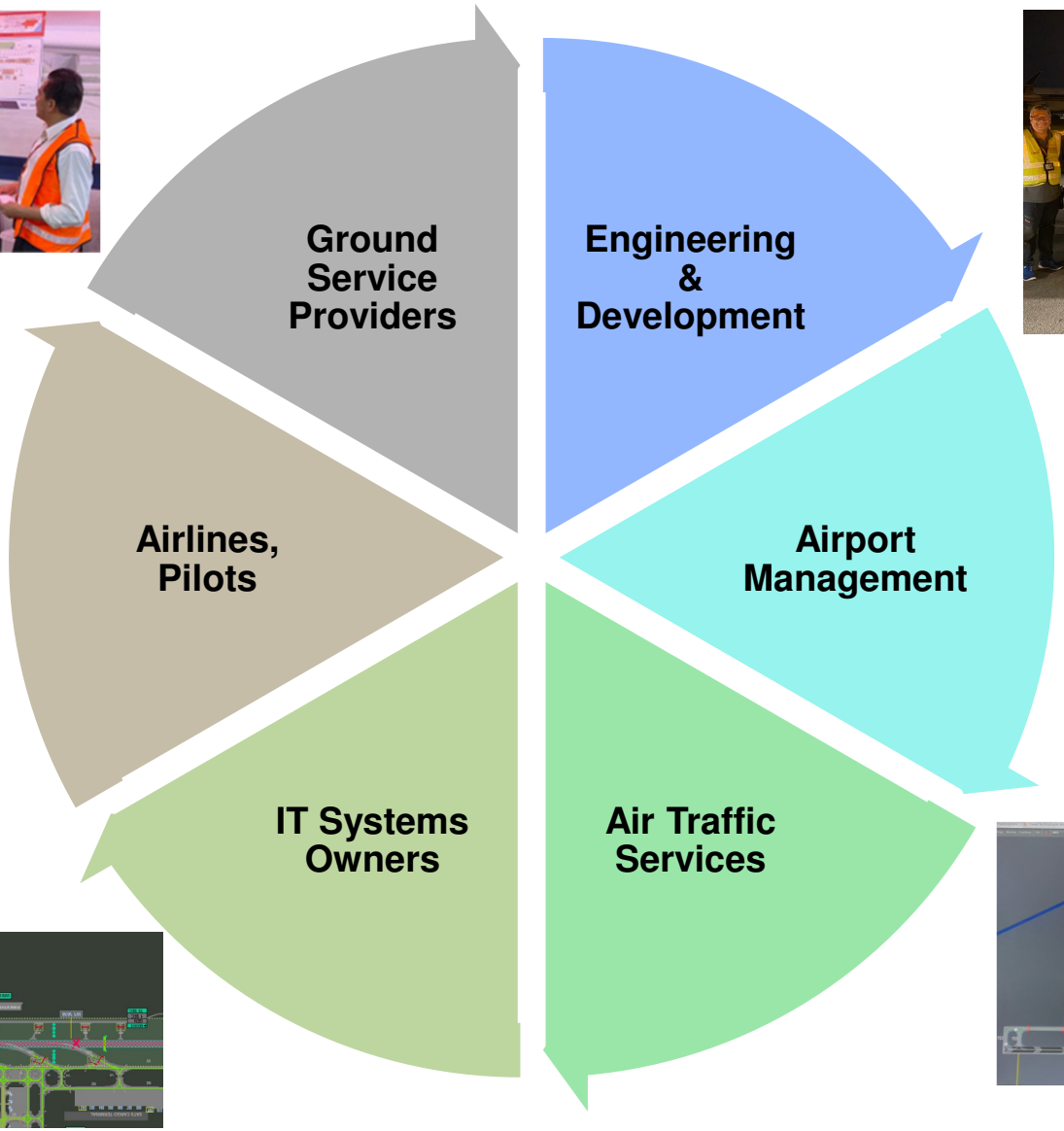
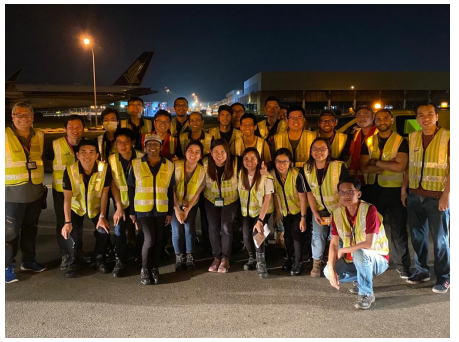
Close collaboration among airport stakeholders when planning the works and preparing for each transition











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Challenges & Implementation Methodology

SCALE

- Entire Changi West aerodrome was affected, except the South Apron.
- ~1000 Taxiway Guidance Signs were affected.

CONSIDERATIONS

- Busy airport – Needed to strike balance between project and operational needs, as the implementation works required extensive closure of aircraft stands/taxiways/runways.
- Adequate project resources to ensure successful changeover in limited overnight off-peak hours

IMPLEMENTATION METHODOLOGY

- Replacing only the inscription panels of affected Taxiway Guidance Signs – Provided the quickest way to reflect the new taxiway names on changeover day.
- Replacement of the sign boxes were done either pre / post changeover.

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Preparatory Works

PHYSICAL WORKS

To support the quick replacement of the inscription panels on the changeover day, the following preparatory works were done to ensure smooth transition.

- Site survey on the conditions of every guidance sign
- Dimensions of all the existing inscription panels were taken; new ones were fabricated to the same size to ensure they would fit.
- Check and ensure easy removal of existing inscription panels

OTHER PREPARATIONS

- Extensive outreach to airport stakeholders before every phase of implementation
- AIRAC AIP Supplement – Broadcast of change
- Changes to maps and aircraft pushback procedures
- Formulated contingency plans, e.g. designate routes to facilitate towing and taxiing of aircraft, inclement weather response
- NOTAMs were prepared beforehand for activation of contingency scenarios and works postponement so that there was no ambiguity on the wording if they needed to be issued for any changes

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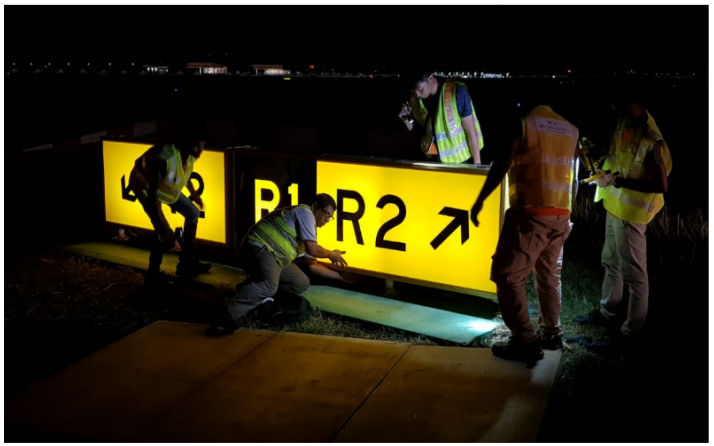
Immersed workers in the live environment prior to the day of changeover works so that tasks could be executed proficiently on the actual day

- **2 rehearsals** were planned to ensure that the work teams were familiar with the mobilisation plan, communications flow, contingency plans, roles and responsibilities
- **Inclement weather response**: once the works started, we had to complete them

Works on actual changeover night

- Replace taxiway information sign panels
- Change of graphics to show new taxiway names for airfield lighting control system and A-SMCGS
- Change of graphics and update aircraft pushback procedures in IT systems and onsite at aircraft stands
- Switch to new version of crash map
- Inspections to ensure accuracy of changes and safety of works
- Issue NOTAMs for completion and any changes



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Readiness programme for the airside community leading up to the night of changeover works

Communications to the following	Estimated Lead Time Prior to Effective Date
International aviation community	AIRAC publication timeline
Pilots	- 4 to 6 months
Air traffic controllers	- 4 to 6 months
Airlines, air freight operators and military operators	- 3 months
Airport Emergency Service	- 3 months
Ground Service Providers	- 3 months
Airside drivers operating in aircraft manoeuvring area	- 3 months
General airside community	- 1 month
Contractors	- 2 months

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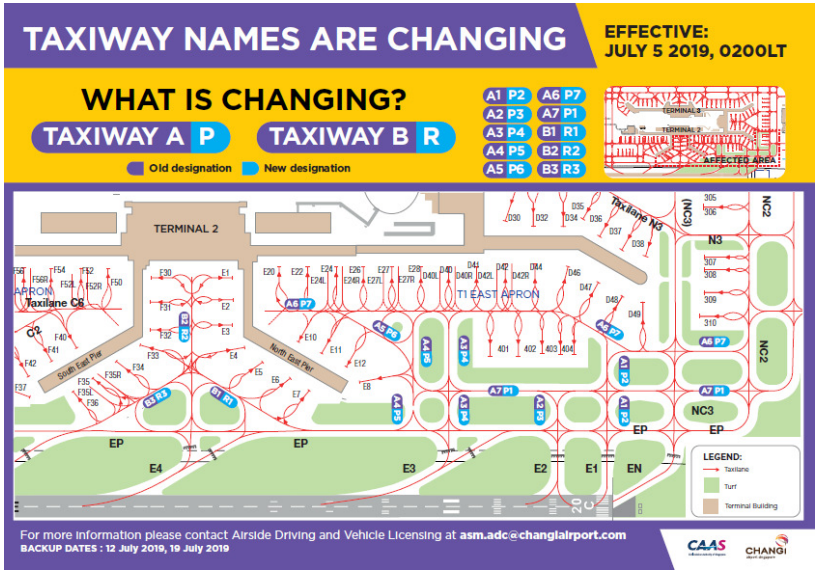
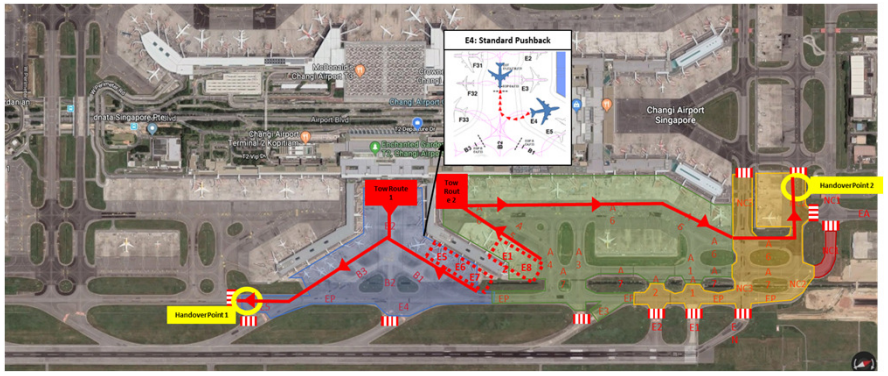
Phase 1 – 5 July 2019

- Smaller phase to build confidence

- Project planning lead time of about 1 year from March 2018 to July 2019
  - Form joint CAAS-CAG Taxiway Renaming Steering and Working Committees and project governance structure
  - Formulate Risk Assessment Framework
  - Formulate Communications and Publicity plans
  - Align on overall project phasing sequence
  - Formulate Real-time Transition Monitoring plan, which involved operations and project teams





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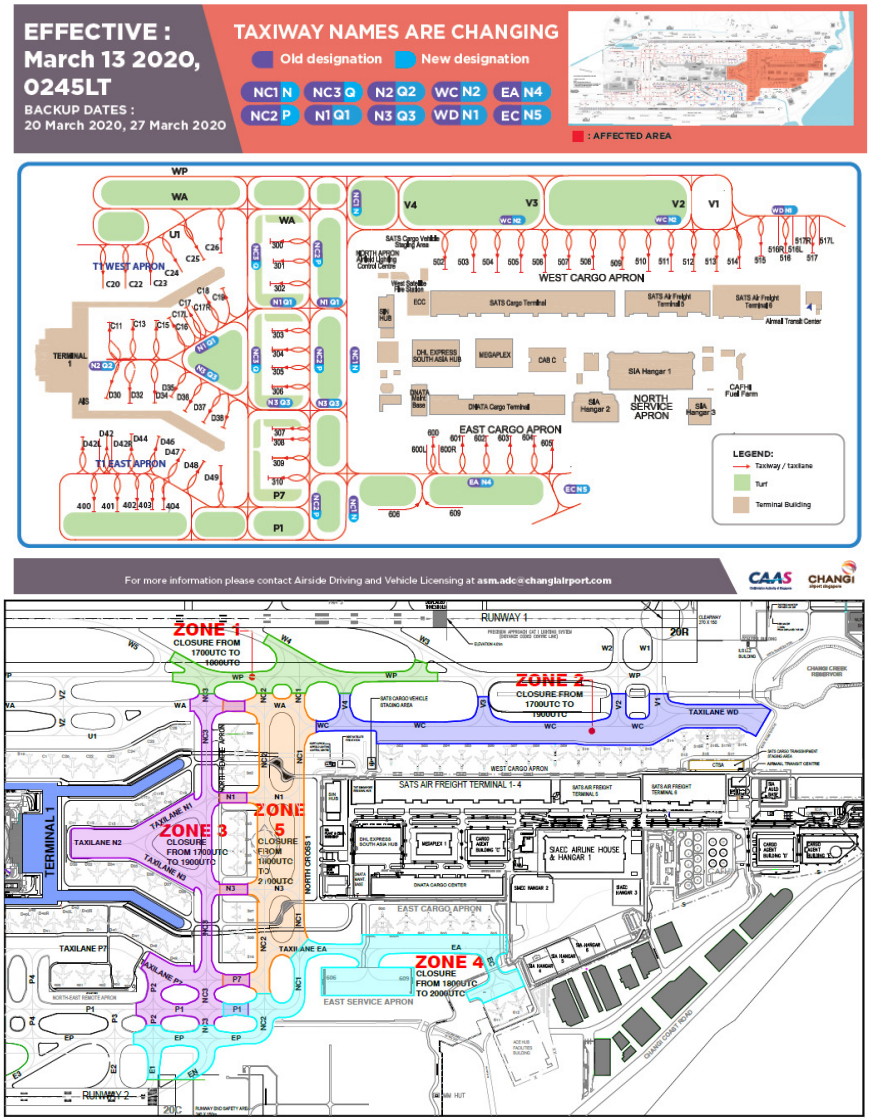
Phase 2 – 13 March 2020

- Project planning lead time of about 8 months from August 2019 to March 2020
- Applied lessons from Phase 1
- Project challenged by:
  - Onset of Covid-19 measures
  - Changeover completed just before the Circuit Breaker (national lockdown) from 7 April 2020



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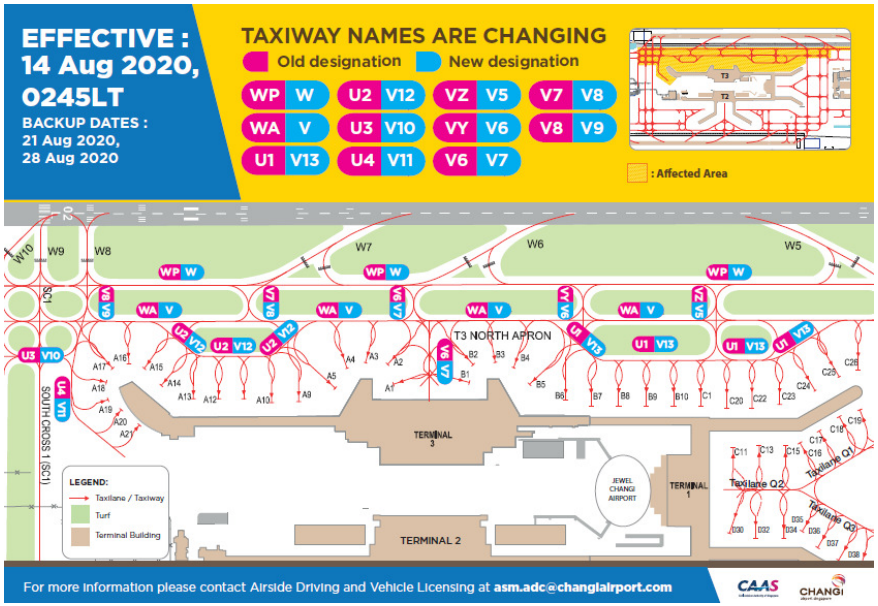
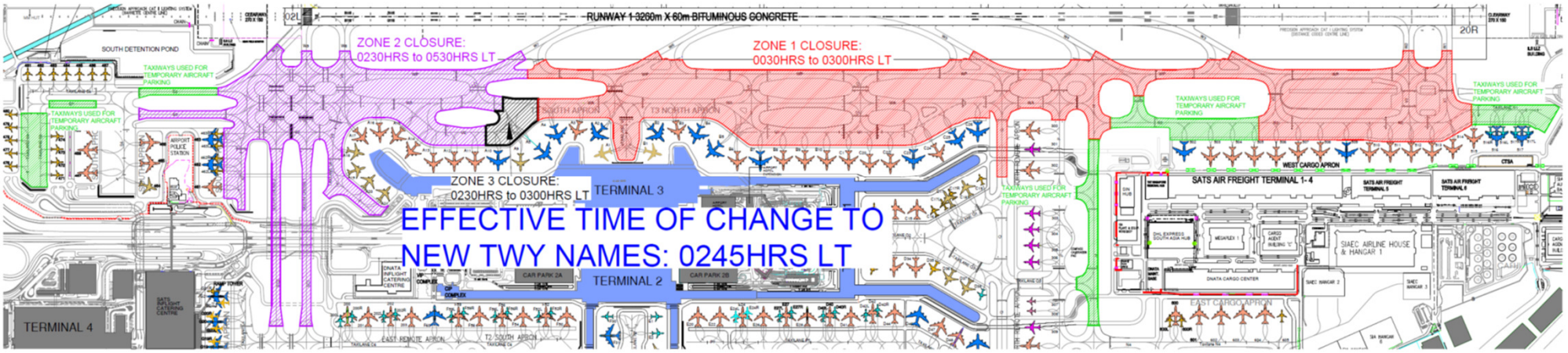
Phase 3 – 14 August 2020

- Project planning lead time of about 5 months from April 2020 to August 2020
- Applied lessons from Phases 1 and 2
- Project challenged by:
  - Tighter Covid-19 measures
  - Onsite Team A/B segregation
  - Reduction in manpower (due to safe distancing) deployed to verify sign inscription changes
  - Selected activities were done remotely





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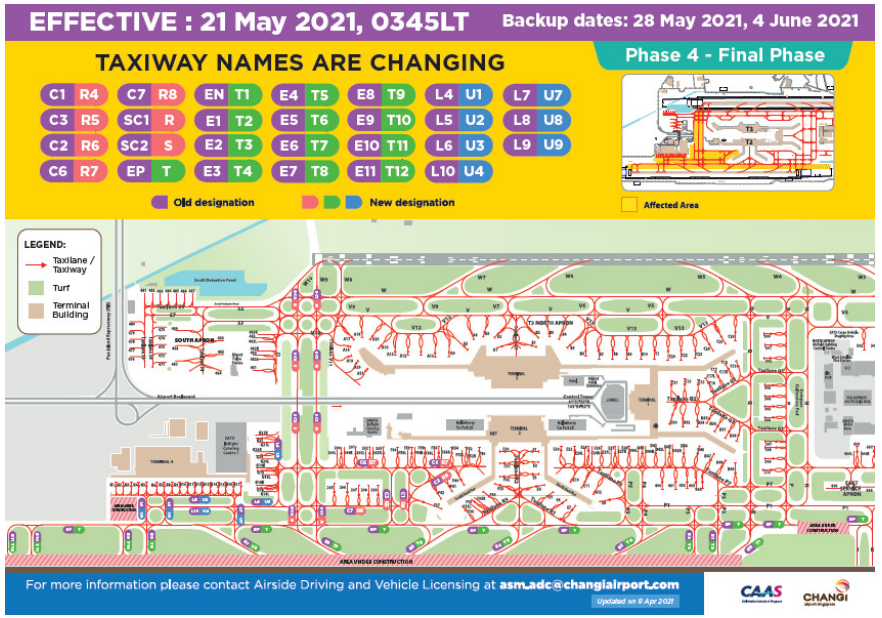
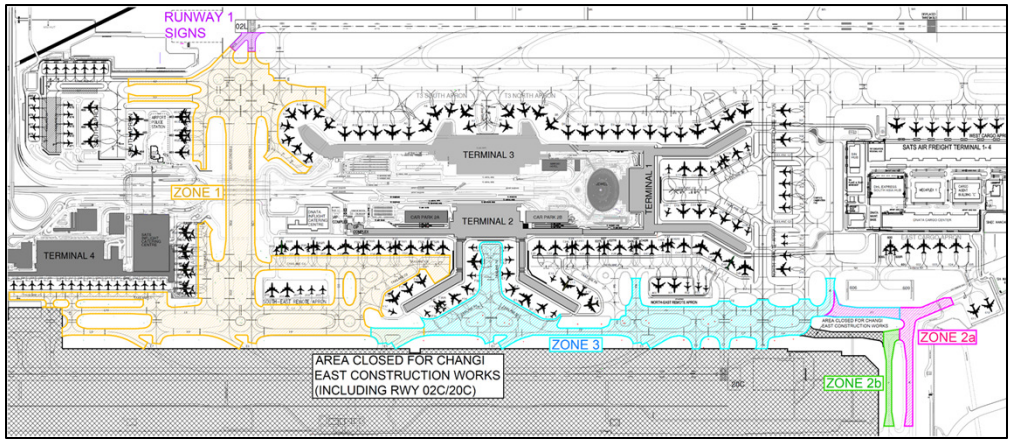
Phase 4 – 21 May 2021

- Project planning lead time of about 9 months from August 2020 to May 2021
- Applied lessons from Phases 1, 2 and 3
- Largest phase of changeover to ride on the low traffic period
- Project challenged by:
  - Most stringent Covid-19 measures
    - Manpower trimmed to the minimum and remote project communication via MS Teams
    - Onsite Team A/B segregation
    - All who were deployed had to be tested negative in the last 14 days





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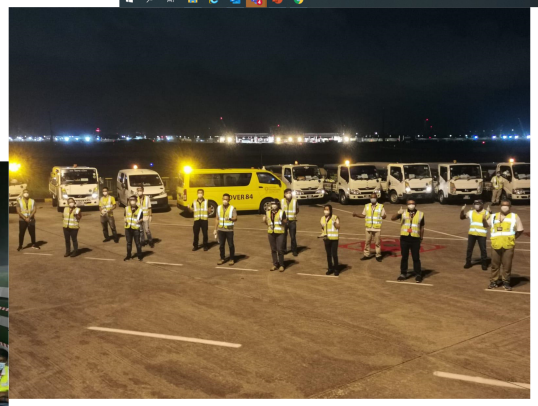
Key project success factors

- Strong project collaboration and trust
- Thorough preparation, but still flexible and fast to adapt project plans to changes
- Clear communication



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Thank you

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