

## Comparative review of Vietnamese standards and guidelines for aerodrome maintenance with ICAO documents

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### ABSTRACT

Maintenance of a civil aerodrome is an extremely crucial aspect in managing and operating airport activities, ensuring the safety, flow, and efficiency of flights. Airport managers must strictly adhere to national standards, guidelines, or documents established by civil aviation authorities. This article provides a comparative review of Vietnamese standards and guidelines for aerodrome maintenance with ICAO documents for a comprehensive understanding of status of this documentation system and a proposal of its adjustment. Methods of document collection and analysis were employed to synthesize information and make assessments. The results indicate that the current documentation system is still incomplete in terms of both form and content. Adjusting, supplementing, and converting standards to make them more complete and widely applicable is necessary and urgent.

**KEYWORDS:** Aerodrome, Pavement, Standard, Guideline, Maintenance

### NOMENCLATURE

TCVN = National Standard of Vietnam  
 TCCS = Fundamental Standard of Vietnam  
 QĐ-CHK = Decision of Civil Aviation Authority of Vietnam  
 CHK = Civil Aviation Authority of Vietnam  
 TT-BGTVT = Circular of the Ministry of Transport of Vietnam  
 NĐ-CP = Government Decree of Vietnam  
 ICAO = International Civil Aviation Organization

addresses issues encountered during operations but also adapts to changes in operational conditions and the aging of airport pavement.

Currently, aerodrome maintenance processes rely on various standards and guidelines, both domestically and internationally. However, domestic documentation remains incomplete due to the historical development of the aviation industry in Vietnam. This article aims to provide an overview and assessment of the standards system and guidelines for aerodrome maintenance used in Vietnam, comparing them with international documents. It proposes adjustments and additions to existing standards, as well as the development of new standards to align with practical needs and international benchmarks.

The research begins by synthesizing and evaluating the system of standards and documents applied in the aerodrome maintenance process in Vietnam. Subsequently, this documentation is compared with corresponding international regulations. Recommendations for adjusting domestic standards are then proposed. Finally, through analysis and comparison, the study draws conclusions and suggests necessary improvements and developments to the standards system and guidelines for aerodrome maintenance in Vietnam.

### 1. Introduction

Vietnam is vigorously focusing on investing in and developing airports to meet the increasing demands for travel, cargo transportation, and to promote economic activities. According to the approved plan for the development of the national airport system for the period 2021 - 2030, with a vision extending to 2050, the number of airports is expected to increase from the current 22 to 30 by 2030, and reach 33 by 2050 (648/QĐ-TTg, 2023).

In the infrastructure of an airport, the aerodrome plays an immensely important role, ensuring that flight operations proceed safely and efficiently. The aerodrome maintenance process must adhere to schedules and technical requirements, while also optimizing economic aspects. Maintenance not only

### 2. Standards system and guidelines for aerodrome maintenance in Vietnam

The civil aviation sector in Vietnam has undergone a process of formation and development through various stages: from

small-scale beginnings to larger scales, from simple foundations to modern systems, and from an incomplete state to a more complete one (CHK, 2018). Currently, Vietnam is gradually mastering the processes and technologies involved in the development, operation, and maintenance of airports, contributing to the sustainable development of the domestic civil aviation industry.

The aerodrome maintenance process relies on standards and guidelines compiled from both domestic and international documents, which exist in various forms depending on the issuing authority and scope of application. These documents include standards and guidelines such as Decrees, Circulars, and Decisions. TCCS are compiled by the CHK and reviewed by the Ministry of Transport. TCCS are applied to activities within the scope of the publishing organization. Decrees are issued by the Government and have the highest legal validity. Circulars are issued by the Ministry of Transport, providing detailed guidance for implementing legal provisions. Decisions, issued by the CHK, concern the implementation, guidance, or management of specific activities in the aviation sector.

The current standards and draft versions related to aerodrome maintenance are listed in **Table 1**.

**Table 1.** Standards and draft versions related to aerodrome maintenance

Standard	Edition
TCCS 30:2023/CHK Standard specification of airport pavement routine maintenance (TCCS 30:2023/CHK, 2023).	1st draft
TCCS 23:2018/CHK Measurement, construction and maintenance of skid-resistant airport pavement surfaces (TCCS 23:2018/CHK, 2018).	1st published
TCCS 06: 2009/CHK Guidelines and procedures for maintenance of aerodromes at civil airports of Vietnam (TCCS 06: 2009/CHK, 2009).	1st published

Publications labeled as 'published' have been circulated and are official in used. Versions labeled as 'draft' will continue to be reviewed for further supplementation, editing, and finalization before circulation.

In addition to standards, supplementary documents for the standards used in airport runway maintenance are compiled in **Table 2**. Guidelines related to aerodrome maintenance

Guidelines	Edition
Decision No. 68/QĐ-CHK dated January 12, 2022 of the CHK on issuing the Guidelines for evaluating and reporting the condition of runway - Reporting Condition Runway Manual (68/QĐ-CHK, 2022).	1st revision
Circular No. 29/2021/TT-BGTVT dated November 30, 2021 of the Ministry of Transport: Detailed regulations on the management and operation of airports. (29/2021/TT-BGTVT, 2021).	1st published
Circular No. 24/2021/TT-BGTVT dated November 22, 2021 of the Ministry of Transport: Regulations on the management and maintenance of aviation facilities (24/2021/TT-BGTVT, 2021).	1st published

Guidelines	Edition
Decision No. 782/QĐ-CHK dated April 7, 2021 of the CHK on issuing Supplemental Guidelines for assessing the condition of runway at airports (782/QĐ-CHK, 2021).	1st published
Decree No. 05/2021/ND-CP dated January 25, 2021 of the Government on the management and operation of airports (05/2021/ND-CP, 2021).	1st published
Decision No. 5002/QĐ-CHK dated October 13, 2011 of the CHK on issuing Guidelines for measuring the friction coefficient of airport runways in Vietnam (5002/QĐ-CHK, 2011).	1st published

When implementing maintenance for airport runways, it is necessary to coordinate standards and documents. This integration is presented in **Table 3**.

**Table 3.** Combining standards and guidelines for aerodrome maintenance

Maintenance	Collaboration document
Pavement surfaces	* TCCS 23:2018/CHK * Decision No. 68/QĐ-CHK * Decision No. 782/QĐ-CHK * Decision No. 5002/QĐ-CHK
Aerodromes	* TCCS 06: 2009/CHK or TCCS 30:2023/CHK (when effective) * Circular No. 29/2021/TT-BGTVT * Circular No. 24/2021/TT-BGTVT * Decree No. 05/2021/ND-CP

## 2.1 References for standards and guidelines

Standards are developed from both domestic and international documents. External documents include indexes, manuals from the ICAO, and other sources from the United States (US), France, and Russia. The ratio of document usage for compiling standards is summarized in **Table 4**. It represents the proportion of documents from each organization cited among all reference documents.

**Table 4.** Percentage of reference documents used for standards

Standard	Vietnam	US	France	Russia	ICAO
TCCS 30:2023/CHK	45%	48%	0%	0%	7%
TCCS 23:2018/CHK	0%	100%	0%	0%	0%
TCCS 06:2009/CHK	70%	12%	6%	6%	6%

TCCS 30:2023/CHK primarily incorporates documents from domestic and US sources, with ICAO contributing a very small portion. TCCS 23:2018/CHK relies entirely on US documents. TCCS 06:2009/CHK is predominantly based on domestic documents with a minor contribution from external sources. The documents cited from the US have been recommended for use by ICAO, while the guidelines are derived from ICAO and domestic regulations.

The process of selecting reference documents is based on scientific criteria and the experience and knowledge of the members involved in the drafting committee.

The structure of TCCS 06:2009/CHK is constructed from documentation from France, Russia, and the US to develop a comprehensive outline. Meanwhile, the content is based on

sources from Vietnam and the US, along with standards and manuals from ICAO. Combining these sources helps establish a feasible and applicable standard that meets maintenance process.

Subsequent standards development, such as TCCS 23:2018/CHK, TCCS 30:2023/CHK, tends to incorporate more internationally oriented external documents, including those recommended by ICAO and other relevant sources.

Currently, there are updated versions of international and foreign documents, but Vietnamese documents have not been refreshed. This lack of updates can lead to gaps in maintenance information, increasing safety risks during operations and hindering international collaboration with foreign organizations. It also limits access to new technologies and materials from developed countries, impeding development and innovation in related fields. Therefore, updating these standards and guidelines is essential to address these issues. In an era of globalization, updating based on ICAO-recommended documents and other relevant sources is not only encouraged but also necessary.

## 2.2 Subjects in standards and guidelines

In the standards, the objects and types of pavement structures referred to are summarized in **Table 5**.

**Table 5.** Subjects and types of pavement structures in standards

Standard	Subject		Pavement structure	
	Runway	Taxiway, Apron	Rigid	Flexible
TCCS 30:2023/CHK	✓	✓	✓	✓
TCCS 23:2018/CHK	✓		✓	✓
TCCS 06:2009/CHK	✓	✓	✓	✓

TCCS 30:2023/CHK specifies technical requirements and provides guidance for the management and implementation of routine maintenance and minor repairs of airport pavements and associated components. TCCS 23:2018/CHK sets out technical regulations for measurement devices and methods for measuring friction coefficients. It covers maintaining these coefficients from construction through to maintenance operations, in accordance with ICAO regulations, to ensure the safety of aircraft takeoff and landing operations. TCCS 06:2009/CHK is applicable to regular maintenance and minor repairs of airport pavements and associated components. However, it does not cover major repairs. TCCS 30:2023/CHK is being developed to supersede TCCS 06:2009/CHK. However, it is still in draft form and has not been officially released. The guidelines detail the objects and types of pavement structures according to the standards they supplement.

The system of standards and relevant documents for airport pavement maintenance in Vietnam recognizes two primary types of structures: rigid Portland cement concrete pavement and flexible asphalt concrete pavement. Portland cement concrete pavement is predominantly used due to its long history in airport infrastructure construction and its durability.

Conversely, many countries have widely adopted asphalt concrete pavement because of its several advantages, including a smoother surface, cost-effectiveness, and the ease and speed of construction. This type of pavement allows for nighttime work when aircraft operations are minimal and offers a quicker turnaround for service after construction. Repairs on asphalt are also more time-efficient and often of higher quality (White, 2018). However, in Vietnam, the practical application of asphalt concrete is still limited due to incomplete standards, insufficient documentation, and constraints in construction technology and materials. Currently, asphalt concrete is primarily used in some small military airports, a few auxiliary infrastructure components in civil airports, and for the repair and upgrading of existing airport infrastructure.

## 3. Comparison with ICAO documents

The prioritization of using international standards and documents, particularly those from the ICAO, is strongly recommended as they reflect the global trends in the aviation industry. However, any gaps in these documents can be filled by referring to countries with long-standing aviation histories.

Currently, Vietnamese documents primarily reference domestic sources and those from the US, particularly from the Federal Aviation Administration (FAA), the American Society for Testing and Materials (ASTM), and the American Concrete Pavement Association (ACPA). Multiple documents from the ICAO are being utilized for analysis and comparison.

The comparison focuses exclusively on the ICAO versions relating to the relevant content. Detailed content analysis and further supplementation will be addressed in future research. Regarding aerodrome structures, ICAO's contributions include Annex 14, Part 1, and its manuals. These documents are synthesized and compared with domestic standards and guidelines in **Table 6**.

**Table 6.** Comparison of ICAO references in domestic documents with current ICAO documents

Content	Combined standards and guidelines applied in Vietnam	Documents ICAO
Routine maintenance, and minor repairs of airport pavements as well as other related items	* TCCS 30:2023/CHK (based on Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 8th Edition, July 2018; Aerodrome Design Manual – Runways (Doc 9157 – Part 1), 4th Edition, 2020; Assessment, Measurement and Reporting of Runway Surface Conditions (CIR 355) and other documents); * Circular No. 29/2021/TT-BGTVT; * Circular No.	* Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 9th Edition, July 2022 (ICAO-Annex 14-Volume I, 2022)+ Corrigendum no. 1 dated 20/7/23 (ICAO-Annex 14-Volume I-Corrigendum, 2023); * Aerodrome Design Manual – Runways (Doc 9157 – Part 1),

Content	Combined standards and guidelines applied in Vietnam	Documents ICAO
	<b>24/2021/TT-BGTVT;</b> * Decree No. <b>05/2021/NĐ-CP.</b>	<b>4th Edition, 2020</b> (ICAO-Doc 9157-Part 1, 2020); * Assessment, Measurement and Reporting of Runway Surface Conditions ( <b>CIR 355</b> ) (ICAO-CIR 355, 2019).
Technical regulations on measuring devices, friction coefficient measurement methods, and maintaining friction coefficients from construction to operational maintenance as specified by ICAO	* <b>TCCS 23:2018/CHK</b> (based on <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 8th Edition, July 2018;</b> Airport Services Manual - Part II - Pavement Surface Conditions ( <b>Doc 9137P2</b> ), <b>4th Edition, 2002</b> and other documents); * Decision No. <b>68/QĐ-CHK;</b> * Decision No. <b>782/QĐ-CHK</b> (based on <b>CIR 355</b> of ICAO and other documents); * Decision No. <b>5002/QĐ-CHK.</b>	* <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 9th Edition, July 2022</b> (ICAO-Annex 14-Volume I, 2022) + Corrigendum no. 1 dated 20/7/23 (ICAO-Annex 14-Volume I-Corrigendum, 2023); * Airport Services Manual - Part II - Pavement Surface Conditions ( <b>Doc 9137P2</b> ), <b>4th Edition, 2002</b> (ICAO-Doc 9137P2, 2002); * Assessment, Measurement and Reporting of Runway Surface Conditions ( <b>CIR 355</b> ) (ICAO-CIR 355, 2019).
Routine maintenance, and minor repairs of airport pavements as well as other related items	* <b>TCCS 06:2009/CHK</b> (based on <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 4th Edition, July 2004</b> and other documents); * Circular No. <b>29/2021/TT-BGTVT;</b> * Circular No. <b>24/2021/TT-BGTVT;</b> * Decree No. <b>05/2021/NĐ-CP.</b>	* <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 9th Edition, July 2022</b> (ICAO-Annex 14-Volume I, 2022) + Corrigendum no. 1 dated 20/7/23 (ICAO-Annex 14-Volume I-Corrigendum, 2023);

Content	Combined standards and guidelines applied in Vietnam	Documents ICAO
		* Airport Services Manual - Part IX - Airport Maintenance Practices ( <b>Doc 9137P9</b> ), <b>1st Edition, 1984</b> (ICAO-Doc 9137P9, 1984)

The update process of ICAO documents often results in the release of new versions that completely replace the old ones. A similar principle is followed for airport maintenance standards in Vietnam.

However, some ICAO documents relating to airport maintenance have not yet been adopted or integrated into Vietnamese standards and documents. This may be due to delays in updating and implementing the latest information from ICAO, or other factors such as resource constraints and implementation capabilities. Leveraging and integrating the latest documents from ICAO will enhance the quality and effectiveness of airport maintenance standards and procedures in Vietnam, while ensuring the safety and efficiency of aviation activities.

#### 4. Recommendation

The trend of international integration and globalization demands that standards be updated in line with the common directions of the global community. Failure to update these standards can create difficulties for airport investment and development, and hinder cooperation with foreign partners on such projects. Currently, documents related to airport maintenance standards in Vietnam are still fragmented and lack consistency in their foundational bases and publication formats. Moreover, many contents still rely on outdated standards and do not fully utilize materials from ICAO, which fails to reflect the current situation and is not aligned with current trends.

Furthermore, the content of current domestic standards is still insufficient for full application to airport operation and maintenance tasks. Collaboration with foreign standards is sometimes necessary, but this can lead to various obstacles, prolonged timelines, and increased costs for all parties involved. Therefore, standardization according to international standards is highly necessary and creates favorable conditions for the development of the aviation industry. This ensures that standards are kept up-to-date and are timely adjusted to meet the development of construction technology, materials, and operational factors.

From the synthesized results, it is evident that updating the TCCS and upgrading them to TCVN is necessary. The proposed amendments to the standards have been consolidated into **Table 7**.

**Table 7.** Proposed modifications to the following standards in Vietnam

Proposed updated standards	Upgrading to TCVN and updating ICAO documents thereafter as well as other related source
TCCS 30:2023/CHK	* <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 9th Edition, July 2022 + Corrigendum no. 1</b> dated 20/7/23.
TCCS 23:2018/CHK	* <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 9th Edition, July 2022 + Corrigendum no. 1</b> dated 20/7/23; * Assessment, Measurement and Reporting of Runway Surface Conditions ( <b>CIR 355</b> ).
TCCS 06:2009/CHK	* <b>Annex 14 - Aerodromes - Volume I - Aerodromes Design and Operations, 9th Edition, July 2022 + Corrigendum no. 1</b> dated 20/7/23; * Airport Services Manual - Part IX - Airport Maintenance Practices ( <b>Doc 9137P9</b> ), <b>1st Edition, 1984</b> .

In addition, the standards need to include more detailed provisions regarding the maintenance of asphalt concrete pavement structures, especially under conditions of high temperature, heavy aircraft loads, and high traffic frequency (Pham and Nguyen, 2019).

## 5. Conclusions

The research involves synthesizing and analyzing the current standards and regulations used in Vietnam for airport maintenance also comparing them with international documents from ICAO. Vietnamese documents primarily adapt domestic standards and incorporate ICAO documents as well as those from countries with developed aviation industries, such as the US, France, and Russia. However, the utilization of the latest global reference documents has not been fully implemented in Vietnamese standards. Furthermore, some ICAO documents have not been fully utilized for comparison and application in Vietnamese standards. The intention to update Vietnamese standards follows a similar approach to ICAO, where updated documents will replace older versions.

In terms of content, maintenance standards address two types of pavement structures: Portland cement concrete and asphalt concrete. However, the section on asphalt pavement does not fully reflect changes in construction technology, materials, and operating conditions. This can lead to deficiencies in applying standards to practice and affect the effectiveness of airport maintenance processes. Additionally, the currently applied standards focus on minor repairs and do not address medium and major repair work within airport maintenance activities.

Given the issues mentioned, it is essential to revise, supplement, and upgrade the TCCS into TCVN to ensure consistency and broader application within Vietnam's aviation industry. The implementation, development, and completion of

Vietnam's airport maintenance standards will establish a comprehensive, cohesive, and scientific documentation system applicable to all airports across Vietnam.

Future research will focus more specifically on comparing the advantages, disadvantages, and scope of application of domestic and international document systems in more detail.

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