

# Quality standards of road surveying in Morocco

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Morocco

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## SUMMARY

During the last decade, the Ministry of Transport (Morocco) has deployed efforts to realize a major road infrastructure to provide transport fluidity, comfort and safety. However, roads constructions still have real problems of organization, management and a lack of documentation structuring the terms of the different collaborators.

Knowing that the final quality of a road project requires the involvement of different actors in a quality policy, and due to the importance of surveying in the success of this type of projects, the surveyor must also adopt a quality process of its interventions in the execution of a road project.

Our study proposes a guide to organize the surveyor operations and to implement a quality approach in surveying services related to road projects in moroccan context. We adopted the following steps : (1) Review and projection of the quality standards to surveyor tasks in Moroccan road works; (2) Establishment of a guidebook detailing the different procedures for monitoring and checking surveying operations and (3) Conception of sheets to organize documentation and monitoring on the field and recording the history of the various operations carried out.

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## 1. INTRODUCTION

The economic development of Morocco drove the governmental authorities to adopt politics towards the road sector by dedicating it some important investments. However, the piloting of a road project requires cooperation between the different intervening actors, among them; the surveyor engineer plays a fundamental role in the construction of a road project. Indeed, the surveyor sets out and checks several operations in different components of the project in order to satisfy the requirements of quality and to guarantee the security and the comfort for the future users of the road.

Morocco is in phase of launching big road projects. The final quality of these projects is evaluated directly by the users of the road. This quality is the result of the action of all those that contribute to its implementation. However, the sector of construction of roads in Morocco continues to have repetitive organization and technical problems. Indeed, the road construction projects lack organization in the surveying operations, what affects considerably the quality of the implementation. Besides, the texts of law regulating the intervention of surveyors in a road project, don't give clear standards of the surveying intervention and the responsibilities of surveyors within a road project. There is also a lack in procedures orienting the surveyor work and the absence of traceability of the surveyors operations.

To give some solutions to these problems and to achieve the requirements of the quality, the setting up of a documentary structure of the surveying operations proves to be important. This paper gives a summary of some solutions to organize the surveyor operations and to implement a quality approach in topographic services related to road projects in Moroccan context.

We adopted the following steps:

- (1) Review and projection of the quality standards to surveyor tasks in road works;
- (2) Establishment of a guidebook detailing the different procedures for monitoring and checking the surveyor operations;
- (3) Conception of sheets to organize documentation and monitoring on the field and recording the history of the various operations carried out;

## 2. SURVEYING TASKS IN A ROAD PROJECT REALISATION

In the execution step, the surveying engineer's intervention becomes indispensable. The surveying follow-up is organized according to four categories:

- Preliminary tasks: they consist of the census of the constraints and the restoration of networks (electric, communication ...), the check of the main traverse, the establishment of the alternative traverses, the general setting out of the centre line and the auxiliary setting out.
- Earthworks and water sanitation: it is about the initial survey of land level upon the site, the setting out of pegs showing excavating limits, fill and cut works, the setting out of longitudinal sanitation network, the setting out of the transverse sanitation network.
- Pavement works: The road paving consist to the follow-up of the execution of the different layers constituting the road pavement. These layers are: the rolling layer, the base layer and the foundation layer.
- Structures construction: like bridges and water collectors.

From what precedes, one can note the importance of surveying operations in a road construction project. So, the surveyor must respect a quality process to enhance his intervention. In what follows, we are going to present a quality process adapted for Moroccan surveyors exercising in the execution step of the road projects.

## 3. QUALITY APPROACH IN ROAD PROJECTS

In the current economic context of our country characterized by the liberalization of the exchanges and by an increasing evolution in terms of quality requirements, Moroccan enterprises are brought to adopt a quality strategy in order to better satisfy their customers. Thus, the surveyor should improve his interventions in the execution of a road project either in the step of production or in the step of check operations.

We have made a survey of the methods and the tools of the quality defined by the international organization of standardization (ISO) in order to adapt them to the surveying field in the road projects in Morocco.

### 3.1 ISO standards

The standards ISO 9001 gives the requirements of the quality (*what it is necessary to do*). This international standard specifies the requirements relative to the quality management system when an organism (1) must prove the capacity to provide a product regularly in conformity with the requirements of the customers and with respect to the national standards, (2) aim to enlarge the satisfaction of his customers by the integration of the process approach

at the setting up of a quality management system and remain centered on the necessity of these processes and their efficiency.

### **3.2 Quality management system**

The quality management system is a set of instructions necessary to the mastery and to the enhancement of the various processes of an organization that generates continuous enhancement of its results and performances. To fulfil these requirements, four types of actions must be considered: identify the objectives and the processes to provide the required results, apply these processes, check each step of these processes and report the result of every operation and finally undertake the actions to enhance the performance of the processes permanently.

### **3.3 Quality documentation**

The main objectives of the documentation concerning the quality are the followings: insure the communication of information which facilitate the follow-up of the project, give the proof of conformity of each intervention and to share the knowledge between different experiences.

## **4. QUALITY GUIDE IN SURVEYING TASKS IN MOROCCAN ROAD PROJECTS**

### **4.1 Introduction**

The realization of the quality approach for surveying operations in the execution of road projects requires preparation of documentation of everything that must be done, and the establishment of traceability tools. In what follows, we will give examples of these documentation and tools.

The examples are given from a proposed guide that defines the approach to follow for the execution and the check operations, for the following lots: earthworks, sanitation, pavement and structures. It gives the surveying processes, the monitoring and check documentation and the standards of surveying operations.

To do this, three road projects were visited. These projects have different characteristics (cost of construction, work organization, type of road and nature of topography). These projects are:

- Project of duplication of the national road (RN2) between Tangiers and Tetouan.
- Project of development of the Mediterranean rocade between Tetouan and Jabha.
- Project of Construction of highway between Fez and Taza.

During such visits, emphasis was placed on the organization methods between the different collaborators, the operations of monitoring and check at the various phases of work, as well as on the different problems encountered in the execution.

## 4.2 Levels of surveying check operations

The check within the company must include the internal check carried out by the surveyor of the company and the external check carried out by the quality service. This will ensure the availability of means and methods of checking (staff, materials), the presentation of results and their dissemination and finally the archiving of checking documents. Another check is called the outside check, which shall give the validation of the two previous checks or claims non-conformity in the contrary case. Figure 1 illustrates the surveying check process.

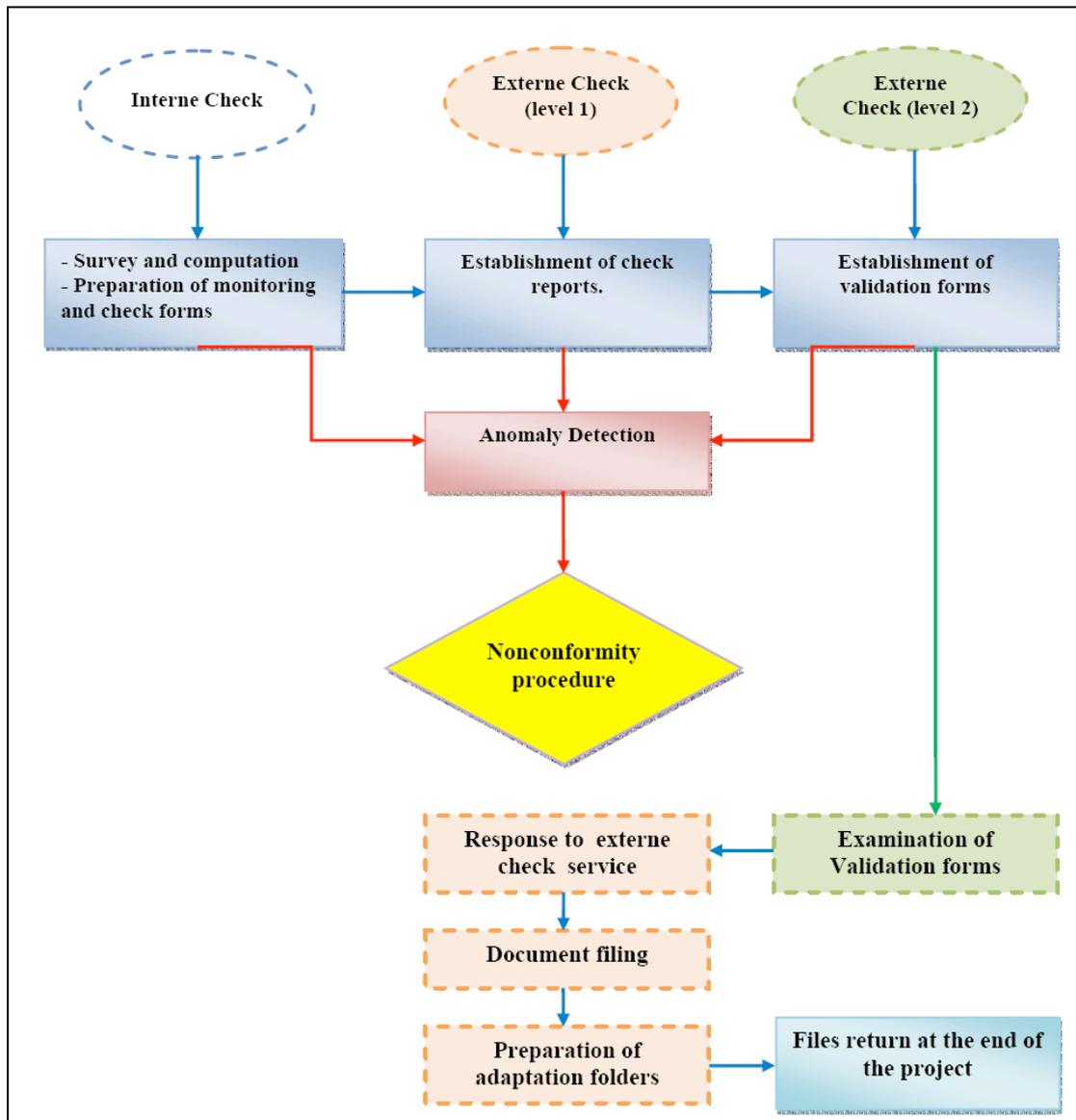


Figure 1. Surveying check process

### 4.3 Nonconformity management procedure

Nonconformity is a situation in which a check proved to be out of tolerances. It is therefore about an event susceptible to have an impact on the final quality of the project. We distinguish two levels of nonconformity classified by ascending order of their degree of importance and the impact on the final quality of the works:

- Minor nonconformity (Level 1): This type of nonconformity can be raised in advance by fixed corrective measures and documented by the procedure of execution and check approved previously.
- Major nonconformity (Level 2): This type of nonconformity involves the application of a known repair procedure but must be submitted to the approval of the work master.

Nonconformities are reported in monitoring documents, and imply the opening of a Nonconformity procedure. It consists of the followings actions:

- To locate the position of the part of the project concerned.
- To describe the observed phenomena (simple report).
- To specify the criteria of non satisfied acceptance.

Then an analysis report of nonconformity and a corrective action must be proposed and accompanied by:

- A description of the preventive measures destined to avoid similar nonconformity.
- An adequate procedure, if a repair is considered.
- An action proposed by of the quality responsible service.

The following diagram explains the nonconformity management procedure.

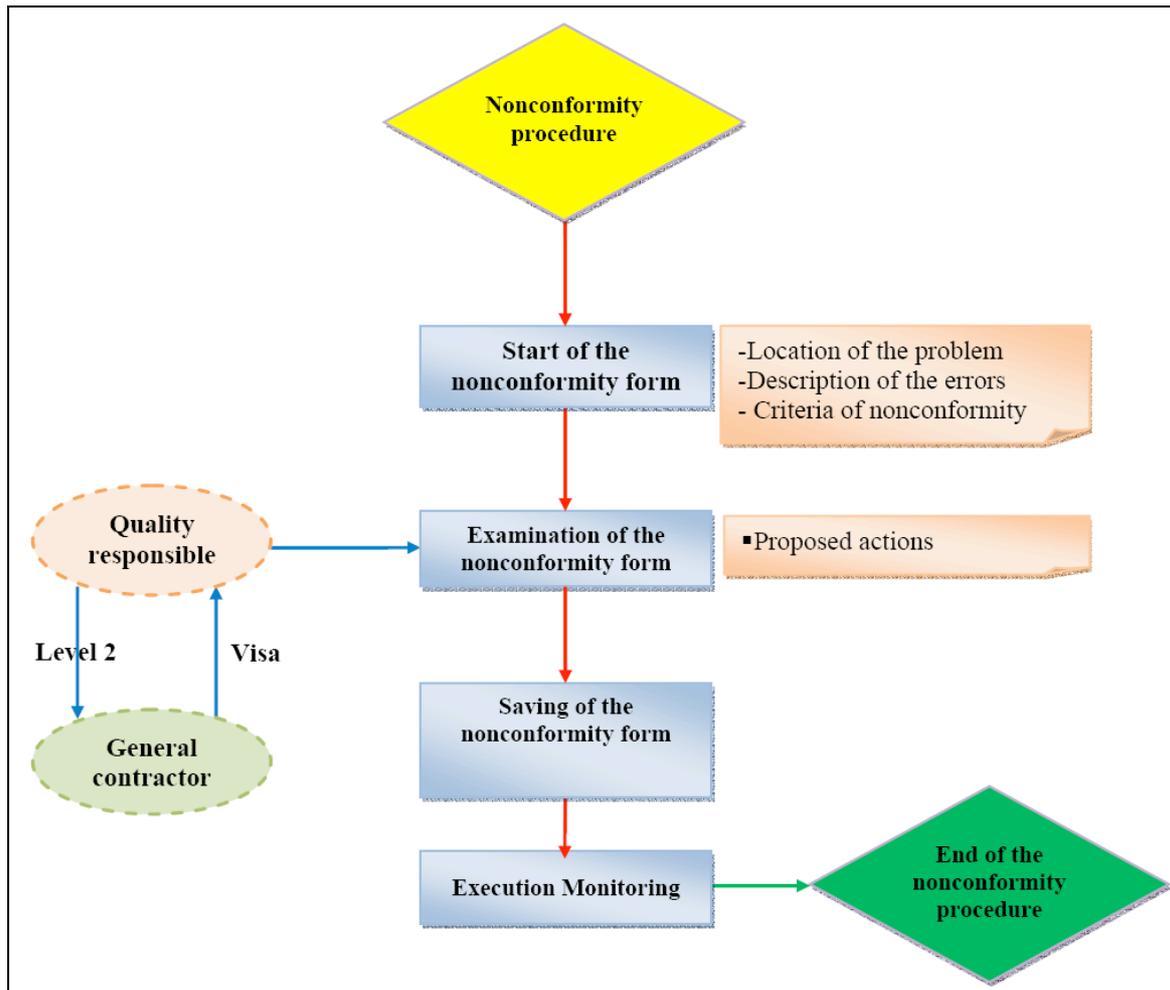


Figure 2. Nonconformity management procedure

## 5. AN EXAMPLE OF A QUALITY SURVEYING PROCEDURE : EARTHWORK MONITORING

The check is about the levels and the slopes of the fills and the cuts. It is realized every 20 meter, 3 points for the slope and 8 points for the road profile. The observed point's coordinates are compared to the calculated ones. The differences are obtained in plan and in altitude. The internal checking achieves the survey of 100% of the realized profiles, whereas the external check realizes only 20% of the profiles achieved. For the upper layer, a check is necessary for the layer thickness and width.

The following figure summarizes the earthworks monitoring process.

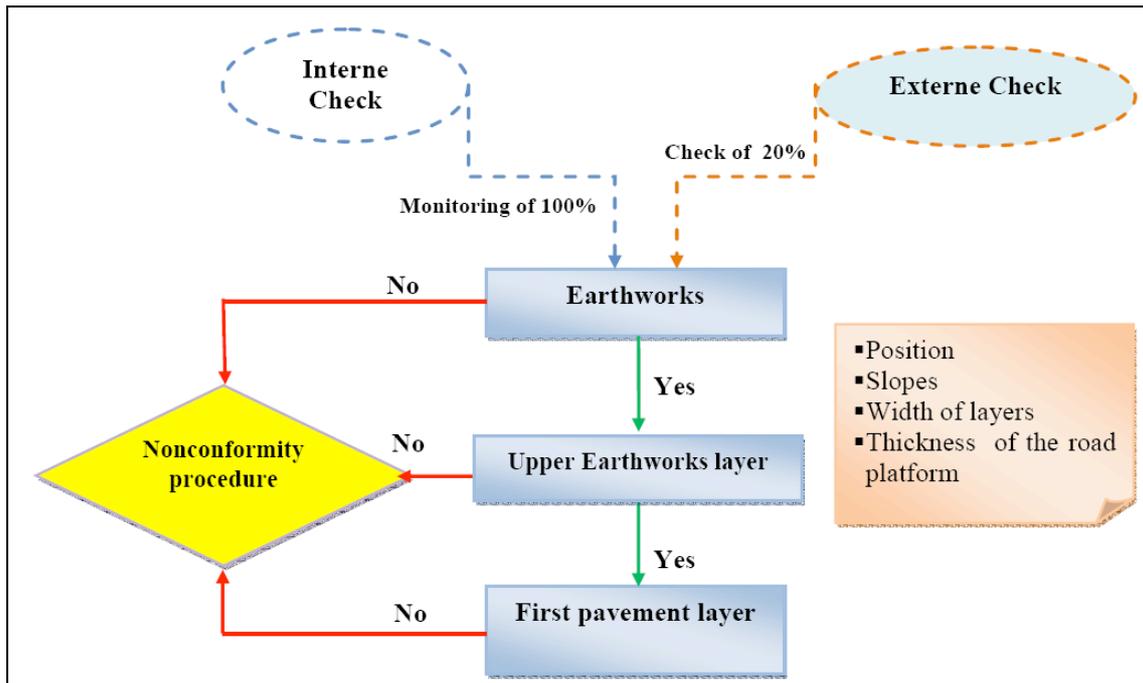


Figure 3. Earthworks monitoring and check process.

## 6. CONCLUSION

In this paper, a quality approach of the surveyor interventions in the execution of road projects has been presented. This approach was based mainly on the principle of the documentation of the standard ISO 9001/2000 in terms of requirements.

The structure of this documentation essentially took the shape of a guide following the wheel of Deming (Plan, Do, Check, Act).

This guide is going to permit to the Moroccan surveyors to valorize and to guarantee the quality of their operations and will be of a big utility for the different actors intervening in the execution steps of a road project. It constitutes a first step toward the conception of a global quality approach of road projects execution and needs complements and suggestions to adapt it to every road project in Morocco.

Finally, we recommend the development of the following aspects:

- Revise the tolerances of surveying check according to the importance and the type of every task and according to new surveying equipment.
- Study the standards in order to integrate the GPS, scanners, aerial and spatial images in the different phases of the execution of road projects.

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