Guidelines for Delay Control in Construction Projects

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ABSTRACT

Project time is one element of construction project triple constraints, which include time, scope and cost so, different researchers shaded the light on the significant factors which may affect the project duration and cause delay or disruption. It is appropriate to identify the need to distinguish between delay and disruption of the projects. Projects may be very badly disrupted without the completion date being affected but construction delay is often responsible for making the project time to be prolonged, causing different losses to the projects. Consequently, the necessity of delays mitigation and control has risen because it usually has an impact on projects cost, depending on who is culpable either the owner or the contractor, they will have to pay to control either delay or disruption. Minimizing the adverse impact of delay calls the developed mitigation measures to avoid the criticality of the inevitable project's delay. The aim of the study is to present some mitigation measures for risks of delay in construction projects which are considered on the standard forms of construction contracts such as the international Federation of Consulting Engineers (FIDIC) and The New Engineering Contract(NEC3) through identification of the responsibilities of each party and providing the guidelines for delay control process .

1. Introduction

Despite the great effort that has been put into the evolution of construction project planning and control during the recent decades, the delay is still a common feature of construction projects. Extended delays often result in adversarial relationships between construction industry (owners, contractors, consultants, etc.): cash flow problems, distrust, litigation, and etc. Projects frequently finish late and/or over budget, thus causing organizations heavy losses and damaging their reputation. Moreover, as projects are hardly ever completed without introducing making changes to their original baseline plan, a major challenge is to accurately estimate the project delivery time, while understanding the effects of other factors that create the discrepancy between estimated and actual project completion times. Thus, the intention of this research is to

quantify the factors affecting duration extensions and to present mitigation measures which help in controlling and managing projects delay. The delays control can be achieved by adopting the process of knowledge management and project learning which gives insight into the various problems and their solutions. In fact, the lessons learned feedback from projects is a real eye opener and helpful for others to avoid similar issues. Delays are of various types and researchers have their own parameters to rate and identify them. Delays have numerous causes which vary from project to project and the causes may be different. Efforts to reduce the delay by mitigation or eliminate the delay by acceleration are measures that can be or may be applicable in some cases and will depend on the projects being considered for those measures.

2. Construction delays types

Construction project delay is the length of time that extends the project duration and causes a disruption in the delivery of project goals and objectives. In construction projects, as well in other projects where a schedule is being used to plan the work, it is the fitting of the final work plan to a time scale and shows the duration and sequence of various construction activities. The owner and the contractor need to have specific deadlines for getting things done. Otherwise, the project may extend for a long time and complete late, so schedules are being prepared to manage and control delays. Before analyzing construction delays, a clear understanding of the general types of delays is necessary. Very broadly, there are two types of delay, delays in activities for which there is programme float available (i.e. they can be delayed without impacting on the completion date) and delays that will impact on the completion date.

There are four basic ways to categorize delays as follows:

- Excusable (The owner default) or Non-Excusable(The contractor default) . (Fig. 1)
- Compensable (The owner default) or Non-Compensable.(Fig. 1)
- Concurrent or Non-Concurrent
- Critical or Non-Critical

Excusable delays entitle the affected party to claim for a time extension, compensation or both as established by contract documents. Meanwhile, non-excusable delays are contract related issues that the contractor or party affected will need to bear the responsibility that could be but not limited to cost and time.Concurrent delays are being used more and more by owners as tools to avoid being billed for extended overhead and similar claims, affecting project completion date. In the same way, concurrent delays are important for contractors as tools to prevent being penalized by liquidated damages and to recover extra costs associated with the issues or delays.

Concurrent delays argument will finally need the backup of a good current construction schedule that will demonstrate how they were affected by, for example; owner decisions or supplied equipment. As for any type of delay, the key aspect to concurrent delays is determining which party is responsible for the delay. Generally, case rulings have acknowledged that two

simultaneous, independent, concurrent critical path delays, one caused by the owner and the other caused by the contractor, have provided the contractor with only entitlement to a time extension to the project finish. Construction delays became an integral part of the project's construction life even with today's advanced technology and management understanding of project management techniques. In the past three decades, project construction contract management and claims encountered the consecutive changes in the construction industry approaches to the rapid changes in construction projects types and related contracts, in addition to the progressive requirements and expectations among the industry stakeholders.

Accordingly, it became common in construction projects to experience schedule delays, cost overrun, increased risks, construction claim, and disputes. Projects frequently finish late and over budget, thus causing organizations heavy penalties and damage their prestige. Moreover, as projects are hardly ever completed without introducing changes to their original baseline plan, a major challenge is to accurately estimate the project delivery time, while understanding the effects of other factors that create the discrepancy between estimated and actual project completion times. The delay may lead to time overrun or cost overrun or dispute or arbitration or litigation so the parties may during the implementation of a contract have claims on each other. Claims may arise for a number of reasons e.g.: unforeseen conditions, acts by the authorities, variations, unsuccessful remedial work, delays, suspension, delayed payment, tests, insurances, force majeure, indemnities, termination etc..

A claim may result in a change to the contract but whether and how the claim impacts on the contract will depend on the content of the contract. The consequence of these new circumstances is that everyone involved in construction and engineering, regardless of sector, have to manage their contracts in a more professional, compliant and business, like manner. One of the fundamental parts of this requires firms to deal with the changes that will surely occur on projects. Delays in construction projects could be as a result of scope change also, where the scope is the term that defines the entire deliverables that are expected at the end of a project.

Another major two reasons for the delay in a project are inappropriate and inadequate procurement and faulty contractual management system as well as the closing of a project contains potential factors that can lead to delays and cost overrun, where being the very last part of the project life-cycle it is often been ignored even by organizations, especially in multi-project environments. Slow project closing could be seen as dragging the various handover activities course by unresolved disputes linked with client acceptance, contracts and procurement, change order issues not resolved, final change orders not issued, poor close out of final account, poor documentation of project success and lessons learnt, slow client acceptance and failing to close the work order can allow unexpected delay and stray charges to be made to the project. Although delay and cost overrun may seem very inherent in most projects, the good news is that it can be reduced or totally eliminated using a proper project performance monitoring and controlling system that will integrate all the key activities of each phase of the project and utilizing the applicable standard forms of contracts such as FIDIC and NEC3.

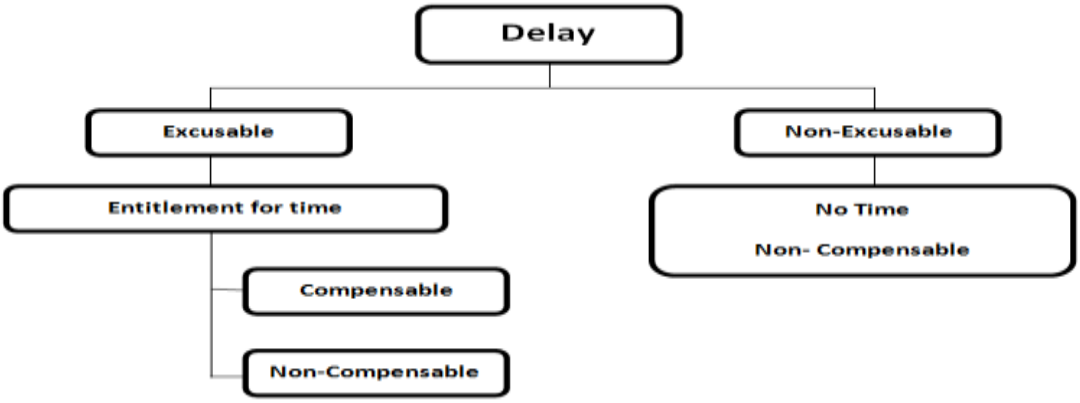

Fig. 1 (Delay categories and actions)

3. Construction Delay causes

Projects have a variety of reasons to experience the delay. According to Abdalla et al (2002), projects encounter massive delays and thereby overshoot the initial time and cost estimates which in turn result in extensive delays providing a platform for claims and disputes. Work from Chan and Kumar Aswamy (2002) from Hong Kong industry gives four major causes of delay in Hong Kong industry which are as follows:

- Project scope
- Project complexity
- Project Environment
- Management related attributes

The above four factors were studied with their constituent casual factors to gain more insight and understanding of their significance. A survey done with the objective of finding the most important reasons for delays as per the traditional contracts indicate that contractors and consultants agreed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning are among the top ten most important factors.

3.1 Additional delay causes

3.1.1 Unreasonable project scope: Project scope is the work that needs to be accomplished to deliver a product, service, or result with the specified features and functions. In project management the term scope has two distinct uses: Project Scope and Product Scope. The scope involves getting the information required to start a project, and the features the product would have that would meet stakeholder's requirements. Effective scope management requires good communication to ensure that everyone on the team understands the scope of the project and agrees upon exactly how the project's goals will be met.

3.1.2 Inadequate early planning: Researchers consider that inadequate planning is the number one mistake in project management and believe that many troubles can be prevented and tracked by effective and efficient planning. A detailed schedule should be created prior to a project starts. Accurate scheduling helps the contractor to determine how and when to complete every piece of the work and estimate the total effort and duration as well as cost estimation helps to create a budget that covers the cost of the project. When everything is agreed and each smaller plan is developed and verified, the contractor can proceed to the next phase of the project. The risk management process can be broken down into two interrelated phases, risk assessment and risk control. Risk assessment involves risk identification, risk analysis, and risk prioritization. Risk control involves risk planning, risk mitigation, and risk monitoring, (Boehm, 1989).

Table .1 shows nine risk items and how the preferred risk management technique from the researcher point of view is.

Risk Item	Risk Management Technique
Lack of exposure to experience with technologies.	Take time to learn tools and technologies, seek help from teaching stuff.
Being overwhelmed by work other projects.	Have a project management plan with deadlines; update the project management plan frequently.
Common meeting times.	In the beginning of the project, determine all possible common time to meet based on the project schedules and other commitments.
Requirements understanding.	Meet with, E. mail, or phone customer.
Lack of communication.	Set up a group Web page, group e. mail accounts, meet regularly.
Project organization.	Assign each team member a role; break down work in project management plan.
Loss of a team member.	Assure files are uploaded and integrated consistently, use knowledge management strategies such as pair programming to understand each other's work.
Difficulty integrating work.	Increase communication, integrate often.
Planning taking up too much time, not enough time to work in product.	Do not get more detailed than necessary with the planning.

Table 1 (Risk items and the control techniques, Risk control process)

3.1.3 Lack of resources: Better productivity can be achieved if project management includes the skills of education and training, the work method, personal health, motivational factors, the type of tools, machines, required equipment and materials, personal skills, the workload to be executed, expected work quality, work location, the type of work to be done, and supervisory personnel (Rowlinson and Proctor, 1999, Wilcox et al., 2000, Lema and Samson, 1995).

3.1.4 Owner interference & decision-making process: Project risk management techniques have matured over time to become a fundamental facilitator indecision making. Nevertheless, risk management in practice is heavily orientated towards the techniques of managing risks and normally less attention is given to the identification of risks (Chapman R.J., 2001). It is not possible to manage risks if the risks are not identified and hence the underestimation of the importance of the risks identification process will negatively affect the effectiveness of a decision.

3.1.5 Inadequate contractor & Sub-contractors experience: One of the most important resources is people and the lack of construction education appears to be one of the major hurdles for small enterprises. Added to this is a lack of management level where a shortage of skilled project managers often has significant consequences for projects and businesses. While management skills are important areas of focus, the industry needs to invest in training from the bottom all the way to the top. Naturally, the quality of the company's employees is also reflected in the quality of the service they provide.

4. Delay control in standard forms of contracts

4.1 Project delays in FIDIC; Majority of construction projects worldwide are administered by FIDIC forms of contract, as well as, FIDIC recognizes delays and related costs, and has provisions related thereto, for example; Sub-Clauses (8.4 to 8.12) & 20.1 (FIDIC 1999Edition). The FIDIC Provisions define the conditions where delays may be claimed as the basis for an Extension of Time (EOT). Some examples are; late provision of design or drawings, unforeseeable Physical Conditions encountered on Site, inclement weather variations instructed by the Engineer and etc,(Sherif A.Oteifa and Moustafa I. Abu Dief, 2016). Meanwhile, the principles of how delay and related costs should be calculated are not defined by the FIDIC, this leads to issues; issues which are usually contentious due to various 'schools of thoughts' and varied interpretations existing worldwide.

In any project there are likely to be changed to the original plan during the project life, and it is crucial to know how the commercial heart of the contract and what rules governs it because change managing starts with drafting and negotiating the contract with care and fore sight. It is not enough to pay attention only to the change control clause, since the basis for its application is some heavy contractual stuff allocating the business value and the risks. When looking at the causes for claims and variations it is advisable to start with the scope of the works. The scope must be carefully and clearly defined. As an owner, you must check that the bid responds to your bid request. As a contractor, you must make sure your changes to the scope proposed in your bid will be part of the contract. Both parties have a task to avoid contradictions or misunderstandings. Make sure your lawyer is familiar with the scope since it is the basis of the remedies clauses. The negotiators and project team members must be aware what the price is supposed to include and how it is structured.

The general assumption is that the price agreed shall cover the scope described in the contract, unless otherwise agreed. Is the price defined as a lump sum or based on unit prices, or both? If the scope is defined in detail, missing details may lead to changes and have an impact on the price. If the scope is defined functionally, by end results, there may be less risk for changes of the price. The contractual change mechanism is often placed in connection with the price clause providing unit prices etc. as a basis for changes to be agreed on. In contractual words, we shall pay attention to clauses like documentation, intellectual property rights, reporting, schedule, delays, testing, take Over, guarantees, indemnities, liabilities, insurances, rejection, termination etc. These clauses may give rise to claims and they are all linked with the scope, the price and the change or variations clauses.

New development of FIDIC conditions of contract "Design-Build-Operate Contract" it was published on 2007 for long term contracts, It has some advantages in term of time where it is with possibilities to overlap some design and build activities it will be possible to minimize delays and optimize the smooth flow of construction activities as well as with cost restraints and commitments and other risks being carried by the contractor, there is less risk of price over-runs.

4.2 Project delays in NEC3; the first step is to identify any risks that are likely to delay or disrupt the works so both the contractor and the owner are obliged to give an early warning notice to the other as soon as either becomes aware of any matter which could increase total cost or delay completion 'Clause 16.1 – early warning notice'. Some clauses in the NEC3 demonstrate and streamline the rights of both parties such as clause 63.3 'delay to completion' which indicates that the contractor's entitlement to an extension of time for completion is judged by reference to the date of the planned completion of his accepted programme, this can be seen in the first part of the clause '… the length of time that, due to the compensation event, planned completion is later than planned completion as shown on the accepted programme.'

Any assessed delay beyond that date caused by a compensation event is added to the formal contract time for completion by adjusting the completion date as well as clause 63.4 that gives the owner and the contractor the right to change the price, completion date and key dates, these are their only rights in respect of a compensation event. Clause 62.2 in NEC3starts with the important statement that quotations for compensation events comprise proposed changes to the prices and any delays to the completion date and key dates assessed by the contractor, the contractor submits an assessment to the quotations and if there is a compensation event then the contractor includes the alterations to the accepted programme in the quotation. The contractor is required to submit quotations within three weeks of being instructed to do so.

Clause 64.1 in NEC3 helps to determine the compensation event where it enables the project manager to assess a compensation event, the intention of the clause seems to be that the project manager has the power to intervene in the assessment process if the rules are not followed; there is, however, nothing in the clause to allow the project manager to make his own assessment simply because he disagrees with the contractor's assumptions in his assessment. Under clause

64.3, if the project manager does make an assessment under clause 64.1 he must notify the contractor and give him the details of the assessment within the same time period which the contractor was allowed (3 weeks). The period runs from the date that the project manager's assessment becomes apparent. In NEC3 forms of contract the project manager has an effective role in the project variations/changes that occur in the construction projects field where the PM can issue instructions relating to changes in scope and completion date and actively monitor by means of an early warning mechanism for any change to scope, price, timings or impairment of performance.

In the same domain in NEC3 forms of contracts the project manager has some responsibilities in time and money whereas the PM can Certify sums due, decide the date of completion and certifying completion (condition 30), notify the contractor of the outcome for any claim for a compensation events and requests quotations for any proposed instruction or changed decision, assesses the additional cost of the contractor not achieving a key date (condition 25.3) and consider compensation events, their value and instructing their implementation (conditions 60-65).

In NEC3, however, completion of a project is when the contractor has done all the work which the works information says he is to do by the completion date and when he has corrected notified defects that would have prevented the owner from using the works. The process of achieving completion itself is subjected to a period of testing led by the supervisor, employed by the owner, who is the ultimate arbiter (not the PM) of whether or not the works are defect-free. Importantly, the contractor remains liable for correcting defects whether or not the supervisor notifies it. As with any contract, whether standard industry or bespoke, the parties need to consider the precise role of the parties.

NEC3 2005 entitles the owner to terminate when the PM advises the owner that the contractor has performed some defaults of those reasons mentioned in the contract, in addition, the contractor has not ceased defaulting within four weeks of the Project Manager's notification to the owner, (Abu Dief, M. 2010).It is worthy to emphasis on the risk inherent with the case when a party initiates a termination process relaying on some reasons which are not sufficient for its entitlement to terminate the contract, it may cause a counter claim which will put the Employer at risk and my losing the case and subject to recovery payment due the contractor. So the NEC3 identified a role for the project manager to carry out which cross check the reasons in such potential termination process (clause 90.1 and Section 18.3). The contract administration can substantially aid the successful completion of a project provided everyone understands the precise scope of responsibility and power afforded to the person undertaking that role.

5. Guidelines for delay control

There are some significant methods which may affect in controlling / minimizing the project delay, these factors as follows: availability of resources, competent project team, competent project manager, accurate initial cost estimates and accurate initial time estimates. Aibinu and Jagboro (2002), in their research identified two methods to eliminate time overrun that were: acceleration of site activities and contingency allowance. During construction stages, the contractor should carry out his responsibility to make sure the work progress can complete in time. If found that work progress are not equal to the estimate schedule. The contractor may carry out with acceleration such as hire additional worker. Besides that, the owner may allow contractor standby some extra cost for unforeseen event such as accidents. According to Odeh and Battaineh (2002), they recommended on improving the situation of construction project that the major method were: enforcing liquidated damage clauses and offering incentives for early completion. According to Nguyen, et al. (2004), "studied the factors that can be applied as a method of controlling / minimizing of construction delays as follows: competent project manager; frequent progress meeting; accurate initial cost estimates; accurate initial time estimates; awarding bids to the right/experience consultant and contractor.

During pre-construction stage, a client should employ a depth knowledge project manager to organize a good project team member to progress the work. Besides that, the project team member should be always discussing with the problem having during the site progress. On the other hand, contractor should employ some employees with experience. So that, during the time or cost estimate they can add on some unforeseen event to avoid the cost and time overrun. Furthermore, the owner should hire some experience consultant and contractor. It is because once they facing problem, they can refer previous project to solve the problem immediately. So, the project can process with smoothly. The significant minimization methods from Koushki et al., (2005), that was identified in their study for the minimization of time delays and cost overruns would require: ensure adequate and available source of finance until project completion, select of a competent consultant and a reliable contractor to carry out the work.

A number of researchers have decried that most contractors' programmes are poorly prepared and not properly updated to reflect changes that occurred during the course of the project. Such deficiencies in programming practice make it difficult for analysts to measure accurately the effect of various delay events on project completion, i.e. to perform delay analysis properly. This is because the most recognized and acceptable delay analysis methodologies are based on construction programmes (typical of which is the CPM), which are required to reflect accurately what actually happened on site as the project progresses (Wickwire*et al*., 1989). Delays may be caused by the owner (compensable delay), by the contractor (non-excusable delay), by acts of god, or a third party (excusable delay), or several different kinds of delays may happen concurrently. In the construction industry, this fundamental principle has transformed into the adage that "work expands to fill available time." Therefore, it is not unusual for an owner-

caused critical path delay to extend the performance of other concurrent contractor work activities.

When a contractor seeks compensation for the owner delay, an owner's typical assessment is that the delays to the other work are concurrent delays caused by the contractor, and therefore, no extended general conditions or home office overhead damages are compensable.Owners are typically not liable to pay for delay costs that they have caused if contractor-caused concurrent delays exist, but they are often liable to provide a time extension, either through express contract language or implied through industry practice.

To counter the owner's argument regarding concurrent delay being non-compensable, contractors proclaim that the alleged concurrent delays were really not independent delays but instead were dependent delays that were the result of work keeping pace with the delays caused by the owner. The contractor's rationale is, "Why should I hurry up and then wait?" Hence, an excuse called "pacing" emerged. Many contractors, however, fail to adequately prove that contractor "pacing" was the sole reason behind intentional, concurrent delays that were directly caused by the owner's critical path delays. Also, courts have been inconsistent in their treatment of this particular concurrent delay issue.

Because of the many sources and causes of construction delays, it is often difficult to analyze the ultimate liability in delay claims, (Zaki et al 1987). In projects where there is a delay where more than one party is involved, it is difficult to analyze the responsibility of the delay. In such cases, it is required to analyze on the basis of the baseline master program of works which is referred to as the as-planned schedule and compare it with the actual updated program which is referred to the as-built schedule. What has to be evaluated in this scenario of analysis is the appropriate schedule which can be done by considering all allowable adjustments to the schedule and then what can be concluded is an as adjusted schedule which will allow for the analysis of the delay and acceleration. The contract is the key document for determining delay requirements.

Most construction contracts allow a contractor to receive a time extension for delays that are beyond the control and without fault or negligence by the contractor (excusable delays). Construction contracts usually limit a contractor's right for extended project costs only for the delays caused by the owner to the critical path (compensable delays). If the contractor is responsible for delaying the critical path, then the contractor receives no time extensions and no compensation (non-compensable delays), and the contractor may be liable for liquidated damages or actual delay damages.

Most construction contracts require the contractor to demonstrate that delays (excusable or compensable) are in fact impacting the project completion date. Owner contracts typically require contractors to utilize the contemporaneous project schedule updates to prove delay as well as calculate the number of days of extension to the contractually-required completion date.

The key elements for a contractor to recover extended project cost due to an owner-caused delay to the critical path are to prove that the work was delayed or hindered, the contractor suffered damages because of the delay or hindrance, and the owner, its agents or other contractors were responsible for the act or omission that caused the delay or hindrance. It is common for construction contracts to not address or defines concurrent delays let alone "pacing." Most construction contracts contain specific language such as, "time is of the essence" or "a contractor shall diligently perform the work" which requires a contractor to expedite the completion of the work. Consequently, most construction contracts do not inherently sanction a contractor to "pace" its work when delayed by an owner-caused impact to the critical path.

However, nearly all construction contracts include an implied warranty that requires the contracting parties not to delay, hinder, or interfere with the performance of the other party. A contractor is allowed to enjoy a least cost performance based on implied warranty. When an owner delays the critical path, the contractor is permitted to mitigate costs to the benefit of the contractor thereby providing a basis for "pacing." Case rulings have acknowledged that the project schedule can change from month to month, and project delays can create float in the schedule. And, under certain conditions, a contractor is not required to "hurry up and wait."

Generally, courts and boards have deemed float as an available time-based resource to be utilized by all parties in "good faith." In fact, many contracts include a specific provision specifying this concept. Construction contracts almost always have strict notice provisions that the contractor must follow when encountering an impact or delay. Notice provisions are intended to provide the owner with the opportunity to mitigate the potential adverse effects from an impacting event. If contractors fail to provide prompt written notice to the owner, it is likely that the courts and boards will rule unfavorably.

Legitimate and well-supported contractor claims have been rendered null and void due to a contractor's lack of timely notice to the owner. Therefore, it is important for both an the owner and the contractor to know what the specific contract requirements are before assuming the risk that one party may or may not be responsible for delay as it pertains to a "pacing" argument. Case rulings have shown that the contractor's delay damages claims are dependent on specific contract language. Further, the success or failure of a contractor's delay damages claim is even more heavily based on the facts underlying the various causes of delay.

6. Conclusion

In construction projects the owner and the contractor need to have specific deadlines for getting things done so a schedule is being used to plan the work and to breakdown all projects activities to streamline and help to control the project phases as well as avoid delays and disruptions. Delays in construction projects could be as a result of scope change, lack of risk management, lack of HR management, inadequate early planning and lack of resources. Accordingly, it became common in construction projects to experience schedule delays, cost overrun, increased

risks, construction claim, and disputes. The majority of construction projects worldwide are administered by the FIDIC forms of contract as well as NEC3 forms of contract. FIDIC standard forms are generally known as being well balanced because both parties bear parts of the risks arising from the project and recognises delay and related costs and have provisions related thereto as well as NEC3 streamlined in its clauses the obligations of each party towards the project delay.

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