

# The three-arched middle Bronze Age gate at Tel Dan - A structural investigation of an extraordinary archaeological site

Rosa Frances<sup>\*</sup>

Department of Architecture, The Neri Bloomfield WIZO School of Design and Education, Haifa, Israel  
Faculty of Architecture and Town Planning, Technion Israel Institute of Technology, Haifa, Israel

## HIGHLIGHTS

- ▶ The three sun-dried mud-brick arches of Tel Dan's gatehouse are a unique structure.
- ▶ These arches are the world's oldest known complete and free-standing 'true' arches.
- ▶ The arches of Tel Dan in a brief archaeological perspective.
- ▶ Structural and technical investigation of the arches and gate's untimely burying.
- ▶ The construction technique as a perception of arches' structural development.

## ARTICLE INFO

### Article history:

Available online 7 September 2012

### Keywords:

Bronze Age masonry  
Gatehouse  
Structural investigation  
Arch  
Sun-dried mud-brick structure

## ABSTRACT

The three sun-dried mud-brick arches of Tel Dan spanning the gatehouse passageway are the world's oldest known complete and free-standing monumental 'true' arches made of this material. This gatehouse is dated to the mid-18th century BC, and stands today more than 7 m high. The city gate was excavated during the 1978–1985 seasons, revealing a vast gatehouse in a remarkable state of preservation. All its three arches were soundly constructed in three concentric radial courses. The archway owes its extraordinary state of conservation to the fact it was filled and buried by the inhabitants after only some years of use. The paper presents the structural and technical investigation of the performance and failure of this unique historic building form, putting it in an archaeological context and discusses the research methods and findings giving a picture of the strength and limitations of the mud-brick arches – extraordinary representatives of historic building technologies. The article puts forward a hypothesis for the construction technique, which could provide a perception of the architectural development of arches and an aspect of the dynamic of learning – in progress in the building cultures.

© 2012 Elsevier Ltd. All rights reserved.

## 1. Introduction

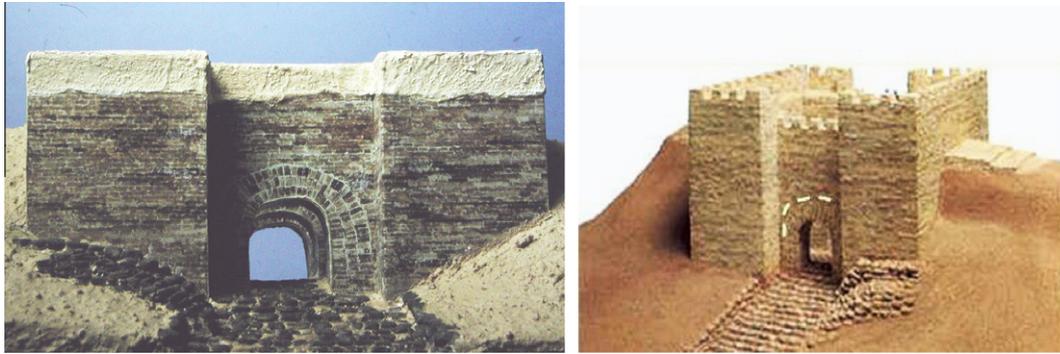
The Canaanite city of Laish – later the biblical Dan – is an archaeological site in North Israel. Located at the foot of Mt Hermon and the Golan Heights and fed by one of the tributaries of the Jordan, the Dan Spring, Laish was a fertile station on the ancient caravan route from Egypt to Syria. The city is mentioned since the 19th century BC in ancient Egyptian and Mesopotamian texts. During the 18th century BC, Laish was fortified with huge man-made earthen embankments which created ramparts encircling the entire city. The ramparts of Canaanite Dan constitute one of the best examples of the defense systems common in that period.

Excavations led by Professor Abraham Biran from the Hebrew Union College-Jewish Institute of Religion's archaeological expedition (HUC-JIR), have been carried out at Tel Dan (as the site is known today) since 1966. The impressive findings included sections of imposing walls and gates, as well as a ritual site dating back to the time of dramatic events recounted in the Bible (Genesis 14:14). A major finding was the uncovering of a complete multi-colored mud-brick city gate on the eastern side of the city, dating from the Middle Bronze Age [1], (Figs. 1 and 2). The gate was excavated during the 1978–1985 seasons, revealing a vast gatehouse in a remarkable state of preservation. This gatehouse, 15.45 m wide and 13.5 m deep, is dated to the mid-18th century BC, and stands today more than 7 m high. Built entirely of sun-dried mud-bricks surviving today as high as 47 courses, the gate is the best-preserved mud brick Bronze Age gate in the Near East [2].

Three enormous intact arches, framing the entryway into the city, among the earliest known examples of an arched structure,

<sup>\*</sup> Address: Department of Architecture, The Neri Bloomfield WIZO School of Design and Education, Haifa, Israel. Tel.: +972 48251790; fax: +972 48340053.

E-mail address: [Francesrz@gmail.com](mailto:Francesrz@gmail.com)



**Fig. 1.** Left: Tel Dan's gatehouse model, adapted from [3]. Right: proposed restoration model, adapted from [5].



**Fig. 2.** Left: gate complex showing the eastern arch and the towers – 1993, adapted from [6]. Right: the eastern façade – now protected under a modern shelter, adapted from [7], with descriptive overlay highlighting the arch – 2005.



**Fig. 3.** Left: gate showing the north tower and recessed archway with steps leading up to it from the east. Earlier steps are visible at the right – 1980. Right: the western façade; going down to the city (today covered); adapted from [3].

are the most remarkable elements of this gate. The arches of Tel Dan – built more than 1500 years before the Romans used arches in their construction – demonstrate expert ancient masonry engineering and fine aesthetic qualities. The gate is noteworthy not only because of its complete three arches and its historic significance, but also because of its excellent state of preservation. The Canaanite gate at Tel Dan preserves the earliest intact archway in the world, nearly 3700 years old. Since their discovery, researchers

have wondered whether these three monumental sun-dried mud-brick arches are not the world's oldest known complete and free-standing true arches.

A second gate structure, albeit less completely preserved, featuring a true arch of the same Canaanite period, has been excavated at the site of ancient Ashkelon – a seaport in the South Israel, by Lawrence Stager of Harvard University. The top of the arch collapsed in antiquity (which may explain the reason why

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات