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The Hippodrome of Gerasa: A Case of the Dichotomy of Art and Building Technology

"Now these [Building] should be so carried out that account is taken of strength [durability], utility, grace [beauty]." (Vitruvius: I, III, 2).

Nothing relevant can be added to Vitruvius' definition of an accomplished work of architecture. Although the two-millennia-old definition is not very revealing because of its obviousness, it still lays down the basic criteria for a critical assessment of every work of architecture, past and present. Thereby, it lends itself well to the discussion of the architecture of the hippodrome of Gerasa.

Vitruvius' definition of his last-listed criterion reads as follows: "... (account will be taken) of beauty when the appearance of the work shall be pleasing and elegant, and the scale of the constituent parts is justly calculated for symmetry". (Vitruvius: I, III, 2).[1] Vaguely defined as it is, the criterion of aesthetics is, in any case, nugatory for the study of circus architecture. By its very nature, this building type did not offer many opportunities for exercise in aesthetics. The main features of the circus were an expanse of flat ground (the *arena*), a series of rooms (the *carceres*) from which the chariots started the race, and thousands of running metres of seating tiers (the *cavea*) for the spectators. There were parts of the building that could be, and in some cases have been, treated more 'elaborately' than the rest of the structure — the façades of the *carceres*, the entrance gates, the tribunals for the magistrates. There was also the barrier in the middle of the arena, often crowded with pieces of decorative art. However, the main body of the circus was architecturally plain, one might say 'puritanical' in its appearance.

It is perhaps not fortuitous that Vitruvius lists durability of the building as the first of his three criteria. On this he writes: "Account will be taken of durability when the foundations are carried down to the solid ground, and when from each material there is a choice of supplies without parsimony [avarice];..." (loc. cit.). The criterion is definite and entirely clear.

Vitruvius' second-listed criterion of an accomplished work of architecture is put into the following words: "...; (account will be taken) of utility when the sites [space] are arranged without mistake and impediment to their use, and fit a convenient disposition [orientation] for the aspect of each kind; ..." (loc. cit.). This criterion, applying to every building, is especially true of circus architecture. The criterion deals with the function of the building and the function of the circus was paramount in the architecture of this particular building type. In no other building type was the function as determinant a factor for the architectural setting as in the circus. This was due to the fact that the function of the circus was much more complex than the function of any other building of the time. The architectural setting had to meet the requirements of a very complex procedure of chariot racing and, at the same time, the requirements of accommodation of huge crowds of spectators. It is therefore the degree of architectural fulfilment of these requirements that must be the main subject of study of circus architecture.

The procedure of the sport of chariot racing has been studied and presented best by J. H. Humphrey in his pioneer work on Roman circuses (1986). It is assumed here that the reader is acquainted with what Humphrey presented on the subject in the relevant pages of his book (1986: mainly 18-24). The complexity of the procedure of chariot racing is very well revealed there.

The requirements of creating proper conditions for the spectators were less complex, yet by no means a simple affair. They involved the provision of seating accommodation for thousands of people and a suitable entrance/exit system. The seating had to conform to the requirements of basic comfort for the spectators and to ensure good visibility of the events taking place in the

[1] Vitruvius' symmetry is not what is presently understood by this term. His definition is: "Symmetry also is the appropriate harmony arising out of the details of the work itself; the correspondence of each given detail among the separate details to the form of the design as a whole." (Vitruvius: I, II, 4).

arena. The capacity of the entrance/exit system had to ensure an easy access to the seating and, what is more important, a speedy exit of the crowd of spectators from the *cavea*.

As in the case of all other buildings, the building of the circus was the work of an architect. It was he who designed the building and, usually, directed or at least closely supervised its construction. He naturally based his design on a general knowledge of contemporary circus architecture but within the limits of that knowledge (and the demands of and means allotted by the sponsor) the final product was of his own making in every relevant respect.

It could not have been otherwise in the case of Gerasa's hippodrome, designed and built in the second half of the second century AD (Ostrasz 1989a: 71; 1989b: 334; 1991: 240f.). At that time there was — as Humphrey puts it — "... a clearly defined building type of the circus, and no provincial architect commissioned to build a monumental circus would think of changing the fundamentals of that design in so far as it concerned the way in which the building catered for the sport of chariot racing." (1986: 55). Humphrey calls it the canonical circus and writing of the architectural setting catering for the sport he uses the term "standardization of arrangements" (1986: 88). This view seems to suggest that an architect designing a circus in the second century had nothing else to do but to copy a ready model of the building, with little or no changes and creativeness. In fact, it was far from that. The view on the standardization of arrangements is acceptable but only insofar as it means merely that to cater for the sport, the building had to have the arena with the barrier and the *carceres*. To this there can be added the layout of the *carceres* and, in most but not all cases, the inclination of the barrier relative to the longitudinal axis of the arena.[2] The fundamentals of design of the architectural setting pertaining to the procedure of the race ended at that.

The standardization, in the strict sense of the word, of the architectural setting for the sport of chariot racing did not and could not exist because the sport itself appears not to have been standardized: we know of no constant of the sport (apart from the case of one and a very particular circus, *infra*), defined either by the distance of the race or by the number of laps in one race. A most cursory review of the circuses which are known from their recorded remains (and/or reconstruction) shows that the distance of one lap of the race (determined by the length of the barrier) was about 300m in the shortest circus on record (Gerasa), as much as about 680m in the longest one (Circus Maximus), and any other distance in between these extreme figures in other circuses. There is evidence for a seven-lap race in the Circus Maximus (for review of the evidence cf. Humphrey 1986: 260-265); thereby the total distance of the race amounted there to about 5000m. However, it is not known whether in other circuses the race consisted also of seven laps, or whether the distance of the race was also about 5000m, or whether neither the seven laps nor the 5000-metre distance was the rule at all.

The implications are obvious. If the 5000-metre distance was the constant, then the race in the shortest circus would have consisted of about sixteen laps. In the ten circuses where the length of the barrier is known, a race would have consisted of 14 or 13, 11, 11, 11, 10, 9/10, 9/10, 9 or 8 laps. On the other hand, if a seven-lap race was the constant, then the distance of the race in the shortest circus would have been about 2100m, and in the ten other circuses it would have been about 2500m or 2650m, 3200m, 3200m, 3250m, 3400m, 3650m, 3700m, 3950m or 4200m.[3] As can be seen, the variety is enormous.

The same can also be demonstrated in terms of the time of one race. In the Circus Maximus a race lasted about 8 minutes.[4] If a seven-lap race was the constant of the sport, then a race would have lasted about 3 minutes in the shortest circus, and about 3.7 or 4, 4.8, 4.8, 4.8, 5, 5.5, 5.5, 5.9, 5.9 or 6.3 minutes in the ten other circuses.

The starting distance (from the *carceres* to the *meta secunda*) fluctuated from circus to circus somewhat less, yet the differences were still considerable. In the nine circuses where this distance is known, it amounted to 110m, 125m, 130m, 132m, 132m, 141m, 158m, 160m and 160m. The chariots would have covered the distance of 110m in about 10 seconds and the distance of 160m in about 15 seconds.

The above differentiations show that the race had to be conducted differently in almost every circus because the architectural setting was different. The architecture itself of the circuses demonstrates that it was not a standardized sport to which the design of the architect had to adhere but that it was the architect who, through his design, ultimately decided how the chariot racing was go-

[2] The inclination of the barrier was customary but it was not an inviolable rule; at least in one case, possibly in two others, the barrier was parallel to the longitudinal axis of the arena.

[3] I am well aware that the data presented here (and which will be presented below) lack the substantiation of evidence for each particular case. However, the space in this paper, already opulently used, does not allow for such a substantiation. The data are abstracted from a monograph being prepared by the present writer and entitled "The Hippodrome of Gerasa. A Provincial Roman Circus", mainly from Chapter 7, entitled "Roman circuses and the hippodrome of Gerasa".

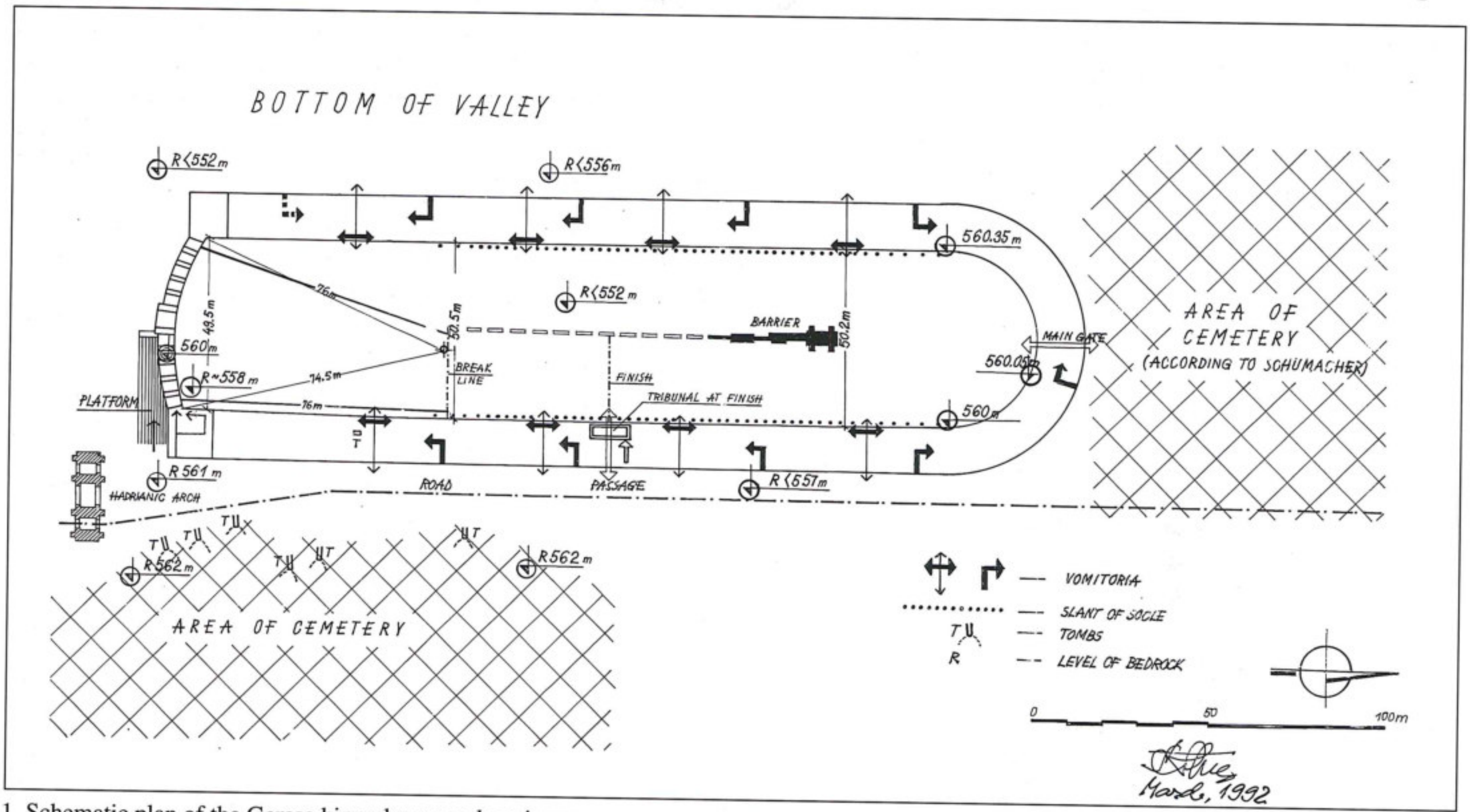
[4] A racehorse of today reaches a speed of about 50km/hour. It is safe to assume that two millennia ago the performance of racehorses was not worse, in any case not much worse. Four horses racing abreast in one team would have been slightly slower but, again, not much slower. The weight of the chariot and of the charioteer could have no significant bearing on the speed of four (or two) horses. The maximal speed could be attained in the straight sections of the race-track. All these things considered, the average speed of the whole race can be assumed to have been about 40km/hour (therefore: 40000m : 60min = 666m/min; 5000m : 666m/min = 7.5min).

ing to be conducted in a particular circus.[5]

The design of the hippodrome of Gerasa is a case in point. The design proves that its author knew well the fundamentals of circus architecture, as they appear to have been in the second century. He designed the *carceres* on a shallow curve of which the cord is inclined in relation to the longitudinal axis of the arena. His design of the stalls of the *carceres* provided for fixing there the gates operated by an opening mechanism. He designed the barrier in the arena[6] and placed what can be seen as the remains of the tribunal at the finish in a point corresponding approximately to the middle (reconstructed) of the barrier, on the side of the right-hand track (FIG. 1). To these fundamentals of design of the circus the architect of the hippodrome adhered faithfully, yet, he created conditions in which chariot racing was substantially different from racing in other circuses, designed by other architects.

The conditions were different owing to the small size of the arena and to the ensuing length of the barrier and the starting distance. In this respect, the architect of the hippodrome faced a formidable challenge in designing the building because the topography of the site chosen for the hippodrome did not lend itself to a longer and wider building.[7]

And yet, in these unfavourable topographical conditions the architect managed to design a serviceable circus. He had at his disposal an area for the arena only 245m long. Along this length he had to fit in the starting distance, the barrier and the space between the *meta prima* and the apex of the semi-circular end of the arena. There is no complete evidence of how he solved this basic problem as only a part of the barrier has survived. It seems that he had no better option than to make the starting distance about 75m, the barrier about 145m and the space for the U-turn at the *meta prima* about 25m long.[8]



1. Schematic plan of the Gerasa hippodrome and environs.

[5] [In] "... a world where charioteers travelled frequently [from circus to circus] ..." (Humphrey 1986: 88) they had to adapt the racing technique to specific conditions offered by each specific architectural setting for the race. This could not fail to have a bearing on the performance of the charioteers, and perhaps horses.

[6] Only a section 35m long (and only the foundations) of the barrier has survived. There is no evidence for its entire length and it is not known whether the barrier was or was not inclined in relation to the longitudinal axis of the arena (Ostrasz 1991: 237-240).

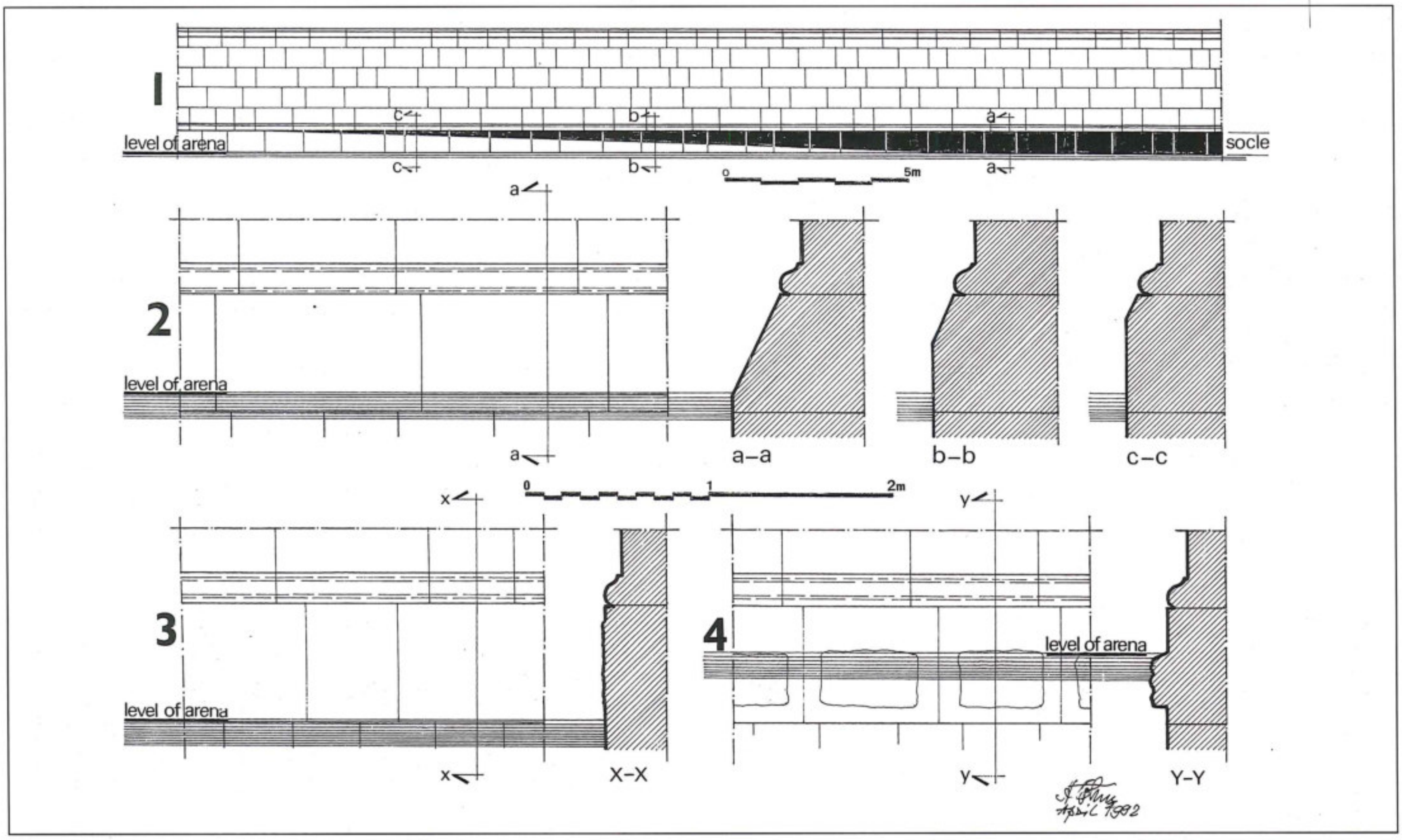
[7] The building could not be extended further to the south because of the position of the Hadrianic Arch, already in place in 129/130 (Detweiler 1938: 73). It could not be extended further to the north, either, because the area north of the present building was occupied by a cemetery (Schumacher 1902: TAFEL 6) which, apparently, could not be encroached upon. The building could not be shifted further to the west, and thus made wider than it actually is, because of the increasing steepness westward of the valley on the slope of which the hippodrome was erected. And it could not be shifted to the east without screening off the north façade of the Hadrianic Arch and without encroaching upon the tombs in the area immediately east of the building (FIG. 1). In every respect, there could hardly be a worse site on which to build a circus.

[8] This might have been the architect's design (and at this point the design is discussed) but the reality was different because, ultimately, not more than five chariots starting from the five eastern stalls competed in a race in the hippodrome (see *infra*).

Owing to the limited width of the arena there was no space for the customary twelve stalls in the *carceres*. The architect therefore designed ten stalls of which each had the minimal width necessary for a *quadriga*. In the remaining space, insufficient for two stalls, he designed a pavilion separating the stalls into two units, each of five stalls. It is not known what solution he adopted to provide enough space for ten *quadrigae* abreast at the break line. The minimum was 27-28m. The width of the arena where this line must have been amounts to 50.5m. Assuming the turning post about 1m wide, the post would have to have been shifted about 3m to the left to obtain the right-hand track at the break line about 28m and the left-hand track about 22m wide. What has remained of the barrier does not contradict the probability of such a solution which would have been consistent with solutions adopted in other circuses.

That the architect took great pains to widen the right-hand track is apparent from his design of the right-hand side of the arena. It bulges outward from the right-hand extreme point at the *carceres* to the point where the semi-circular part of the arena commences. By this solution, known in other circuses, the designer enlarged the width of the arena in the area of the break line to 50.5m from 49.5m at the *carceres*. The left-hand side of the arena he designed to follow the straight line throughout.

There are some refinements in the architectural setting of this hippodrome, relating to the technique of the race, which are not known or have not been noticed in other circuses (but cf. fn. 9). This is the treatment of the socle of the podium wall (the masonry course directly above the surface of the arena). In some sections this masonry course projects from the face of the podium wall proper and it is cut to a slant of which the face recedes from its bottom to its top. The bottom of the slant corresponds to the surface of the arena. The slant was apparently made to protect the wheels of the chariots if they happened to come into contact with the socle.[9] What is significant in this treatment is that the slant exists only in the sections corresponding to the assumed length of the barrier, on both sides of the arena. In contrast, the face of the socle corresponding to the starting distance and to the semi-circular section of the podium wall was left vertical (FIG. 2). This treatment of the socle shows that the archi-



2. Socle of podium wall: 1. socle corresponding to barrier (a-a) and straight stretch north of barrier (b-b, c-c); 2. socle corresponding to barrier (a-a); 3. socle corresponding to starting distance; 4. socle of semi-circular part of podium wall.

[9] A similar treatment of the socle of the podium wall exists in the circus of Tyre. The only photograph that I know shows it to be in the semi-circular section of the wall. I am ignorant if there were or there were not any changes along the other parts of the socle of the wall.

tect did not expect the chariots to come close to the right-hand sides of the tracks between the *carceres* and the *meta secunda* and along the semi-circular side of the arena, but that he expected them to do so in the sections corresponding to the barrier. To cater for this racing technique, the architect designed the relevant parts of the building accordingly.

There is yet another trait of the treatment of the socle which seems to have not existed, or to have not been noticed, in other circuses. This treatment shows all the signs of having been designed to make the track rise as it led around the *meta prima*, along the semi-circular side of the arena.[10] The most probable aim of the treatment of the socle in this part of the arena would have been the creation of most suitable conditions for the chariots to negotiate the U-turn here at the highest speed possible.

The orientation of the hippodrome is ideal; there could not be a better orientation of a circus for the competitors as far as the blinding effect of the sun-rays is concerned. However, as it is the architect's skill in designing the building of the circus that is discussed here, it has to be pointed out that as regards the orientation of the hippodrome it was the topography of the site rather than the architect that was meritorious: once the location of the hippodrome was decided, the architect could not but orient the building north-south. And the position of the *carceres* on the north or south side of the circus (the latter is the case of the hippodrome) was entirely non-essential for the condition of chariot racing as both positions were equally good.[11]

The *cavea* of the hippodrome could accommodate about 15000 spectators. It is worthy of notice that this smallest circus on record occupies the tenth place in the list of twenty-six (larger and much larger) circuses of which the capacity can be estimated with an acceptable approximation. The discussion of the reason for this grandiosity exceeds the scope defined by the title of this paper. This is mentioned here solely because it was a difficult task to design the accommodation for such a number of spectators in the *cavea* restricted by the small size of the building. The architect performed the task expertly. He designed seventeen tiers of seating, comfortable by the contemporary standards (0.7m wide and 0.45m high), and approachable from seventeen *vomitoria*. Eight of these led to the lower and the remaining nine to the upper sectors of the *cavea*.[12] He concentrated most *vomitoria* in the long median parts of the seating, most advantageous for the spectators, thus in the parts where crowding could be expected to be greatest. This arrangement ensured not only an easy access to the seating but also — what is most important in any entrance/exit system catering for large crowds — a relatively speedy exit for all spectators.[13]

Finally, the architect of the hippodrome proved that he also knew how to care for what Vitruvius calls the beauty of the building. As mentioned above, the circus was an 'introverted' building type; only some interior components of the structure lent themselves to a more 'aesthetic' treatment. For such a treatment the most suitable, and a very conspicuous component of the circus, was the façade of the *carceres* on the arena side. Here was the possibility for this treatment and our architect made good use of it. By its very function, the structure had to consist of a series of repetitive open rooms, identical in size and ranged close to each other in one row. The architect designed the façade of the structure according to modular principles. His module was a compositional unit of the 2:3 proportion (width to height). Every segment comprising one stall was designed in this proportion and the same proportion was adopted for the opening of the stall. It seems that the façade of the central pavilion was composed according to the same principle (FIG. 3).[14]

At the same time, the architect showed a commendable restraint in keeping to a minimum what is commonly called the "architectural decoration". He provided the façade with pilasters to emphasize the structural division of the *carceres* into stalls and topped the pilasters with

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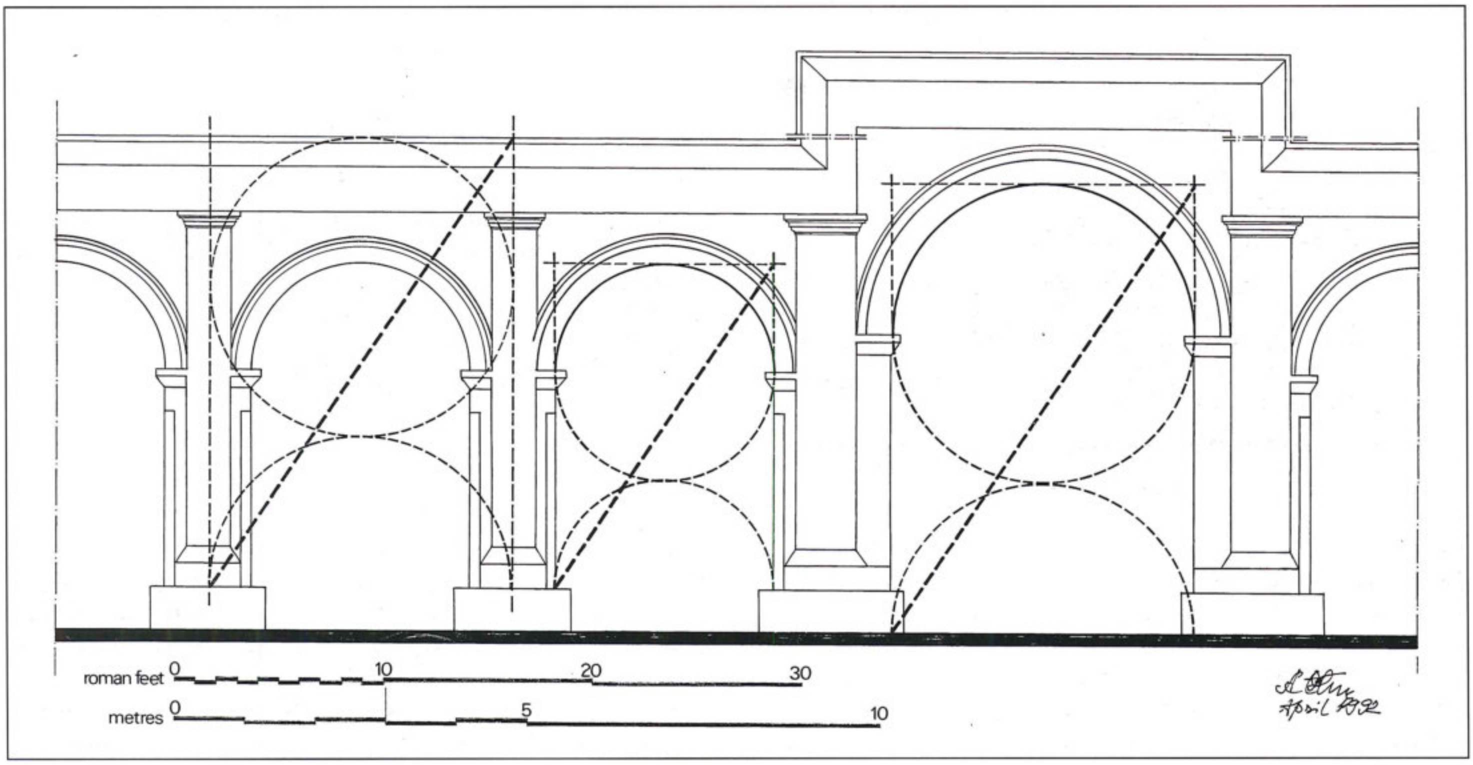
10 The original surface of the arena has survived nowhere but its level is clearly determined by the flooring of the *carceres*. In other parts of the building this surface is marked by the bottom of the slant of the socle of the podium wall. In the sections where the face of the socle is vertical, the surface of the arena is determined by the bottom of the rustication of the stones of which the socle is built. Both the bottom of the slant and of the rustication is practically level throughout the entire length of the right-hand and the left-hand side of the arena. However, the latter is as much as 0.35m higher than the former. The difference results from an upward slope of the top of the socle in the semi-circular section of the podium wall. The slope starts in the last part of the first half (anti-clockwise) of the semi-circle and terminates at the point where the whole semi-circle ends (FIG. 1). The rustication of the stones in this stretch of the socle is very prominent and it occupies only the lower half of the stones; it is obvious that this rustication was meant to be covered by earth making up the surface of the arena (FIG. 2.2). These features show that the surface of the arena along this stretch of the socle sloped upward in the anti-clockwise direction, as the top of the socle.

11 To demonstrate this point properly several calculations and drawings would have to be presented. Let it suffice to mention here only that the position of the sun in the late hours of the morning and in the early hours of the afternoon is high enough (in the latitudes where chariot racing took place) as not to disturb the vision of drivers conducting their vehicles on a level surface. Nowadays drivers of motor-cars know this well. In the early hours of the morning and in the late hours of the afternoon the position of the sun is outside the angle of human vision in the horizontal plane.

12 In most circuses where the relevant evidence is available, one *vomitorium* catered for about 500 spectators. In the hippodrome of Gerasa there was one *vomitorium* per about 800 spectators. Considering the small size of the building and its relatively great capacity, the design can be viewed as successful — more *vomitoria* would have decreased the seemingly planned number of spectators.

13 If the *cavea* of the hippodrome was filled to capacity, all spectators could leave the building in about 25 minutes. To the best of my knowledge, there is no study on the subject for other circuses.

14 There is no full evidence for this feature, possibly because of the way in which the tumble of this part of the *carceres* was excavated and cleared away in 1933 (Ostrasz 1989a: 67, fn. 19).



3. Modular composition of north façade of *carceres.*

simple mouldings. The vaults covering the stalls he showed in the façade in the form of simply carved archivolts. The whole of the façade he crowned with a simple but well proportioned *cyma recta*-cornice. The architect's design of the piers separating the stalls from each other, and especially the design of the imposts of the archivolts, shows ingenuity in achieving a perfect unity of the functional purpose and aesthetic value.

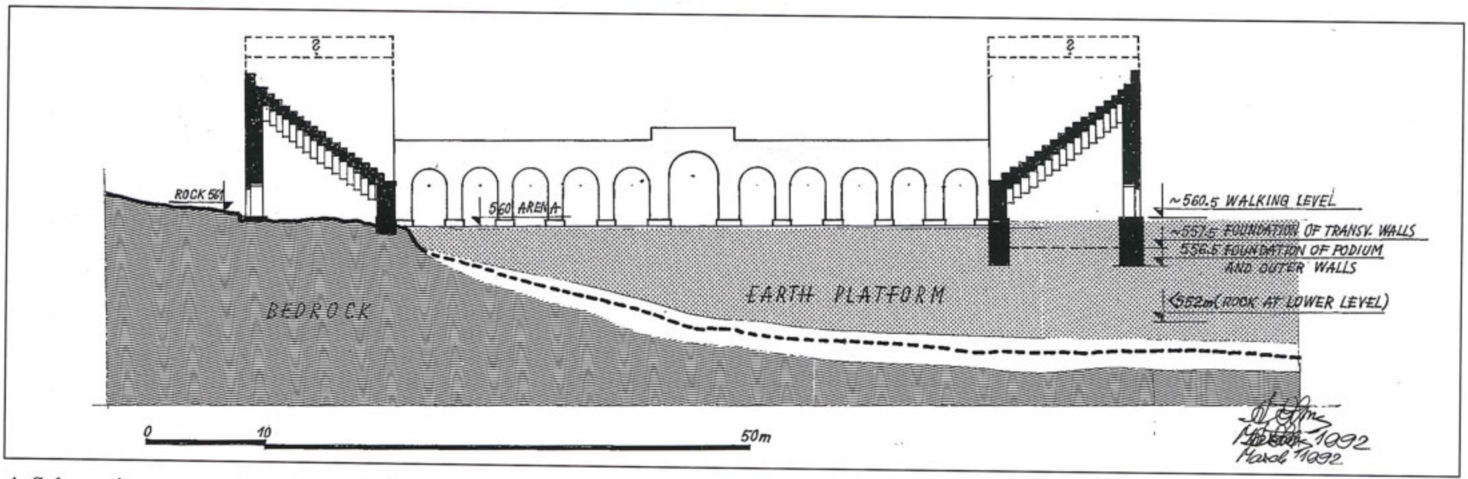
Of course, the architect would not have been a child of his time if he did not use the decorative elements to 'beautify' his architecture, but he used them maturely — to stress the structural and functional nature of the *carceres.* Consistently with his design, the architect designed the exterior of the *carceres* as a plain wall pierced by a series of simple openings, in keeping with the character of the exterior architecture of the whole hippodrome. On the whole, our architect designed a piece of architecture functionally useful and aesthetically graceful.[15]

From the study of the remains of architecture of the hippodrome of Gerasa, its architect emerges as a skilful and, in no few respects, an innovative designer of circus architecture. There comes, however, the constructional technology — an aspect of architecture conditioning the durability of the building — and there the portrait of the architect changes drastically. In respect of building technology, the architect's ability fell far behind his expertise in the other skills: the hippodrome is an example of exceptionally poor building technique.

The manner of founding the building defies all basic rules of construction. Owing to the location of the hippodrome on the western slope of the valley, the foundations of only a very small, south-east part of the building could be set on a solid base (rock in this case). It was there where the architect chose to establish the level of the arena and the walking surface outside the building. From that place, however, the surface of the rock dropped considerably northward and much more so westward. The difference in level was about 7-8m. It follows that the foundations of the west part of the building ought to have been set 7-8m below the designed level of the arena. The architect chose a different way of founding the building. A platform made of earth was formed on the slope of the valley, from its bottom to a level of about 3.5m below the designed level of the arena. On this earth platform the foundations of the building were only set (FIG. 4).[16] The consequence of this solution could not fail to be disastrous because the earth could not

15 Evidence for the third dimension of the *carceres* in other circuses is extremely limited. There are only two other *carceres* which give an idea of what their entire architecture was (or may have been like): the *carceres* of the circuses in Bovillae and Lepcis Magna. None displays anything close to the sophistication of the *carceres* of the hippodrome of Gerasa (FIG. 5).

16 The level of the rock under/along the west part of the *cavea* is not known. The actual lowest level of ground in that area is from 5m to 7m below the surface of the arena (Ostrasz 1989a: FIG. 3). The rock must be at a level still lower. Given this situation, it seemed to be a reasonable assumption that the foundations of this part of the building had been set on rock, that is to say about 7-8m below the level of the arena (Ostrasz 1989a: 61). Only the recent excavation revealed a different reality. I recant the former statement.



4. Schematic cross-section of hippodrome.

fail to settle with time and make the foundations sag. And precisely this did happen.[17]

Another constructional sin of the architect was the construction of the foundation walls themselves. Here he demonstrated a surprising ignorance of the statical requirements of the structure. According to the design, the vertical pressure of the whole structure was sustained by the transverse walls. The entire masonry of the *cavea* rested on these walls. The outer and podium walls carried nothing but their own weight. It was obvious that such a statical composition of the structure required the widest foundations for the transverse walls and respectively narrower foundations for the other walls.[18] Instead, the foundations of the transverse walls are narrower than the others (1.2-1.5m; foundations of the podium and outer walls 1.65m and 2.1m, respectively).

The building technique of the foundation walls evidences a similar misconception. The masonry of the whole hippodrome is of poor quality (Ostrasz 1989a: 67) and only a little more so is the masonry of the foundations of the podium and outer walls. However, the foundations of the transverse walls are built much more poorly. It should have been precisely the opposite — if any foundation had to be built poorly at all. In this situation, the transverse walls — the statical spine of the whole structure — were much more vulnerable than the others to the process of settling of the earth on which they had been founded.

The misconceptions in founding the building and the generally poor constructional technology proved to be detrimental to the longevity of the whole structure.[19] The hippodrome was finally destroyed by earthquakes (Ostrasz 1989a: 74f.; 1991: 242f.) but these destructions belong to the late history of the monument. However, as early as in the first quarter of the fourth century at the latest, the building already did not serve its primary purpose and was used as a centre of ceramic production (Ostrasz 1989a: 73). The reason could hardly have been other than dilapidation of the building, which made it unusable for chariot racing (Ostrasz 1989a: 73). Two components of the circus were indispensable for chariot racing: the arena and the *carceres*. Disintegration of one of them would suffice to make the building unusable for the sport.

It was demonstrated elsewhere that only the five eastern stalls of the *carceres* were provided with the necessary outfits which served for opening simultaneously the gates (Ostrasz 1989a: 70; 1991: 239f.). The five western stalls were never provided with these, thus they never served their purpose. The same is indicated by the foundation of a wall abutting against the outside face of the foundation wall of the *carceres*, built in the place corresponding to the eastern pier of the pavilion (FIG. 1). This wall could be nothing else but the retaining wall of a platform at the back of the *carceres*. The position of the wall shows that the platform gave access only to the eastern stalls. There was no access to the western stalls from outside.

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17 The top of the westernmost part of the foundation wall of the *carceres* (the floor of the extreme west stall) is 0.28m below the level of the top of its middle part (the pavilion). The downward slope westward of the masonry courses of the exposed south face of the foundation wall is clearly visible and there is no vertical crack in any part of the stonework. Nothing but gradual sagging of the foundation wall could make the masonry courses slope so, and nothing but gradual settling of the ground on which the wall was set could be the cause of it.

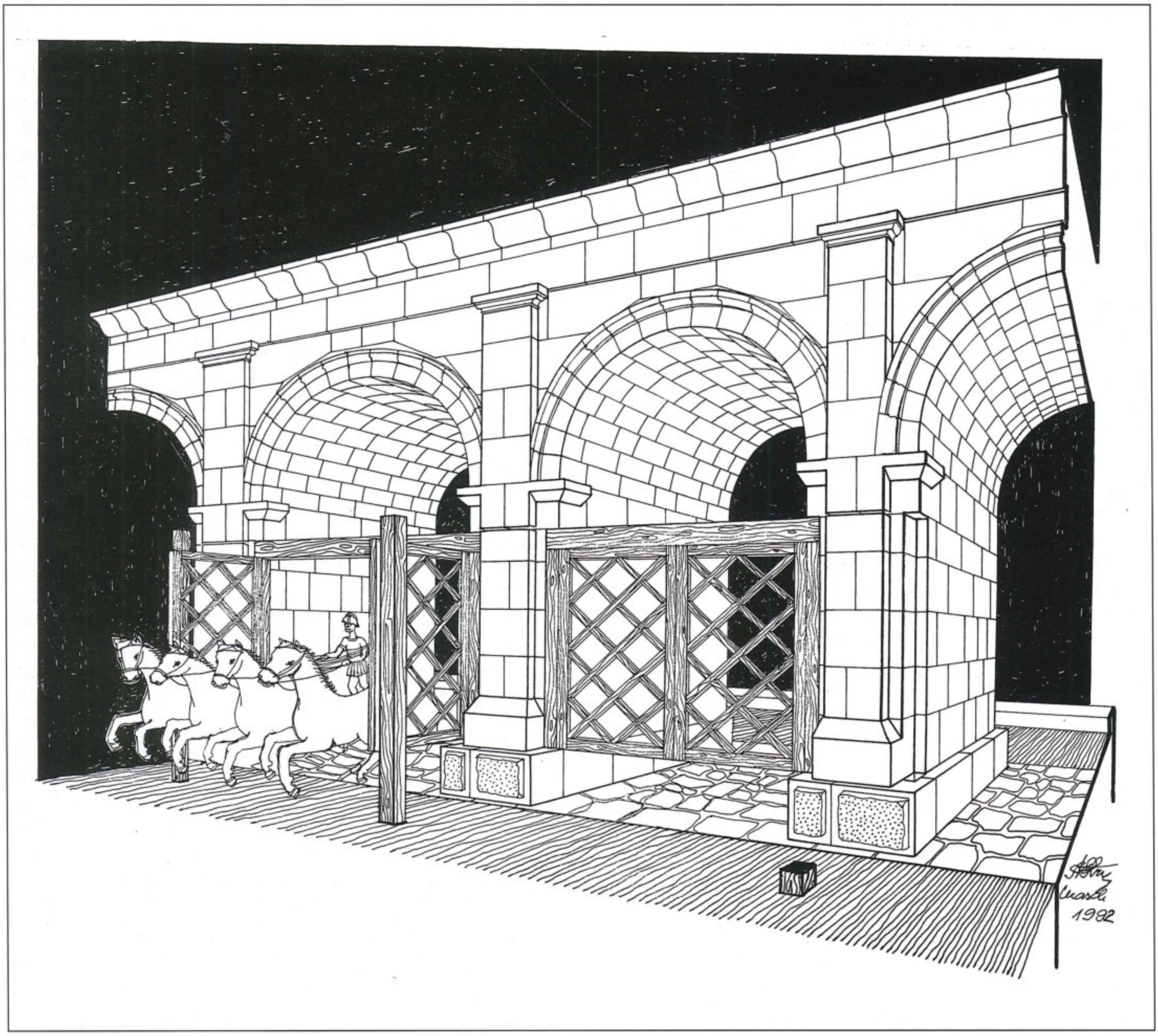
18 One current metre of the foundation of the podium wall carried a load of about 18 tonnes, of the outer wall — about 40 tonnes, and of the transverse wall (the part closest to the outer wall, thus highest and heaviest) — about 47 tonnes. Translating this into modern statical terms, the load of the podium, outer and transverse walls — given the width of their foundations — exerted a pressure on the ground on which they were set equal to 1.1kg/cm^2, 1.9kg/cm^2 and 3.2kg/cm^2, respectively.

19 The hippodrome of Gerasa was not the only structure that was exceptionally poorly built in the lands of the Decapolis. The Monumental Gate in Gadara is another recorded case (Weber and Hoffmann 1990: 300). The sameness of the features of poor constructional technology is striking. What is not striking at all is that the structures so built disintegrated soon after their erection; it would be striking if they did not.

One might argue that the hippodrome was originally designed for only five chariots competing in one race; that the five western stalls were built solely for the sake of symmetrical composition of the *carceres*. The argument is refutable: had such been the case, the outward bulge of the right-hand side of the arena would have been redundant. The bulge had been designed to widen the right-hand track and this proves that this track was designed for more than five chariots abreast at the break line. If the right-hand side of the arena followed the straight line, there still would have been much more space than necessary for five chariots starting from the eastern stalls.

There remains, then, to discuss the question of why the western stalls were not used in spite of the fact that they had been built. What follows is an examination of evidence to this effect.

The appliances for fixing the gates in the stalls and for opening the gates simultaneously included a specific shaping of the piers separating the stalls from each other (the space for wooden jambs and slots in which the jambs were set), and the grooves for a rope (chain?) of the opening mechanism, and the poles in front of the piers (Ostrasz 1989a: 70) (FIG. 5). The two first-



5. Perspective view of part of *carceres*.

mentioned appliances were formed while the part of the structure from the socle of the piers to the level of the springers of the archivolts was being built. In other words, while the western stalls were being built they were meant to be provided with gates. The grooves for the rope were cut in the piers of the eastern stalls only after the completion of construction (this is apparent from the way in which the inner surface of the grooves is cut). The poles in front of the eastern piers were of course fixed there also after the completion of the construction of the *carceres*. As the gates were necessary for the procedure of the race, and the grooves and poles were the necessary outfits for opening the gates, the provision of the eastern stalls with these outfits must have been the closing act of construction — the finish of the *carceres*. The western stalls had been built to receive the gates but they were not provided with the outfits which were necessary to operate the gates. The conclusion is therefore obvious: the builders decided *not* to provide the western stalls with gates *at the very closing stage of construction*. The only explanation for such a decision is that already at this stage it was obvious that the stalls could not serve their planned purpose.

It is inferable what must have happened. The settling of the earth platform made the foundation of the *carceres* sag. The process of settling started, naturally, immediately after the platform had been formed and the settling reached its peak when the construction of the west part of the *carceres* was nearing completion and shortly after the construction was achieved.[20] The parallel subsidence of the foundation made the piers of the stalls lean westward and the inclination of the masonry could not fail to be noticed. The inclination of the preserved parts of the piers (only 1.7m high nowadays) is still conspicuous.

The settling of the earth platform must have been even more detrimental to the outer wall of the building.[21] The process of subsiding of its foundation could not fail to make the wall lean gradually but steadily westward (outward).[22] The southwest part of the outer wall was about 15m high (the height of the foundation included). At this height, the wall must have stood in a very precarious position immediately after the completion of construction. It must have been obvious that it would collapse, and it may have collapsed already in the closing stage of construction. In this situation, no builder would have thought of preparing the western stalls for the start of the race. And so he did not, as our evidence shows. All the above considered, one may entertain the possibility that the very inauguration of chariot racing in the hippodrome of Gerasa took place in the building which was already partly ruined.[23]

In conclusion, we can come back to our two architects: Vitruvius and the architect of Gerasa's hippodrome. The latter showed both prowess and deficiency in many aspects of his profession. This dichotomy was detrimental to the longevity of the building that he designed. By the rules of his profession the hippodrome was, ultimately, 'his baby'. It was he who fathered the hippodrome and it was he who — notwithstanding his other achievements — made it cripple in its infancy and die prematurely. His two hundred-years-older colleague, Vitruvius, would not have thought much of his work.

References

Detweiler, A.H. 1938. The Triumphal Arch. Pp. 73-83 in C. H. Kraeling, (ed.), *Gerasa, City of the Decapolis*. New Haven.

Humphrey, J. H. 1986. *Roman Circuses. Arenas for Chariot Racing*. London.

Müller, E. B. 1938. The Hippodrome. Pp. 85-100 in C. H. Kraeling (ed.), *Gerasa, City of the Decapolis*. New Haven.

Ostrasz, A. A. 1989a. The Hippodrome of Gerasa: A Report on Excavation and Research 1984-1987. Pp. 51-77 in *Jerash Archaeological Project 1984-1988*, II. Paris.

___ 1989b. Jerash - The Hippodrome. Pp. 329-337 in D. Homès-Fredericq and J. B. Hennessy (eds.), *Archaeology of Jordan II: Field Reports*. Akkadica Supplementum VII. Leuven.

20 The process of settling of the ground on which a structure is founded begins at the moment of building the foundations. The intensity of the process reaches its peak when the construction is completed and it lasts during a short time after the completion of construction. The process slows down gradually after that short period and reaches a zero point of settling soon afterwards, the point of final statical stability in normal conditions.

21 The subsidence of the extreme west part of the foundation of the *carceres* being 0.28m, the subsidence of the foundation of the southwest part of the outer wall, about 13m further to the west, must have been as great as about 0.4m.

22 The excavation of the foundation of the southwest section of the outer wall, about 12m long, revealed that the extant part of the foundation (2.5m high) was inclined westward (outward) at an angle of about 9°. There is no evidence for the period in which this inclination occurred. The inclination, enormous as it is, may have resulted from earthquakes which occurred long after the construction of the building, and/or from much later washing out of the earth of the foundation platform. Theoretically, an inclination of the outer wall equal to about 6° had to make the wall collapse — at this angle the gravity centre of the wall would have projected outside the base of the wall. Given the poor building technique of the masonry, the wall should have collapsed at a much smaller angle of inclination.

23 It would have been the southwest section of the *cavea* that collapsed so early. The earth platform carrying the foundation of this part of the building was higher than anywhere else; therefore, the settling of earth and the resulting sagging of the foundation must have been greatest there. In the wake of the collapse, the southwest part of the arena must also have disintegrated which would have made it unusable for racing. The western stalls stood high in their leaning position during the following centuries and they collapsed only under the impact of an earthquake much later (Ostrasz 1989a: 75). Their long survival in spite of this position is explainable. Owing to the constructional composition of the *carceres* (a series of piers spanned by vaults), they were structurally a uniform whole. The inclination of the structure was lengthwise. At the actual angle of inclination, the centre of gravity of the structure as a whole and of its elements sustaining the vertical pressure (the piers) remained within the base of each part of the structure. Its statical stability was of course disturbed but not to the point of collapse. Finally, at the western extremity of the *carceres* (the lowest level of inclination) there was a solid tower which buttressed the whole structure.

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Schumacher, G. 1902. Dscherasch. *ZDPV* 25: 111-177.
Vitruvius (Polio, Marcus), *De architectura libri decem* = Vitruvius, *On Architecture*. Edited and translated into English by F. Granger. London, New York, 1931.
Weber, T. and Hoffmann, A. *et alia* 1990. Gadara of the Decapolis. Preliminary Report of the 1989 Season at Umm Qeis. *ADAJ* 34: 321-342.