

GOODISON PARK REDEVELOPMENT

INTRODUCTION

In recent years a regular assertion has been that it is simply not possible to redevelop Goodison Park due to its confined location etc, with this option simply dismissed out of hand. The irony being, it was in fact this confinement that forced the club's founding fathers to employ stadium visionaries such as Archibald Leitch who, through innovative design developed the then revolutionary double-decker format for which Goodison Park became famous, creating the best stadium in the country with the third highest capacity on one of the smallest footprints of all the major clubs. Indeed, necessity was the mother of invention regarding Goodison Park, both in terms of its initial founding and its subsequent development throughout the decades. This has been a natural evolution, a historic process that need not end now nor in Kirkby where the blank canvas on offer might not prompt such innovation. Obviously Goodison Park does pose design problems, but I will attempt to show how it also provides a neat set of solutions for this historic site and club.

A Design Brief:

Goodison Park: Some of the **basic problems** perceived or otherwise which need to be addressed:

1. **Insufficient capacity** for a club of our status, and with our fanbase. Average attendance over the past 10 years approximately 37,000 despite no success, and with approx 4,000 obstructed seats.
2. **Outdated facilities**, too many obstructed views, and poor sightlines.
3. In parts **shabby/unattractive appearance** to both fans and potential investors. (although this is subjective, since many similarly aging stadia worldwide are cherished because of their history and character..... warts and all. Such as Fenway, Wrigley field amongst others)
4. **Poor executive provision.**
5. **Poor atmosphere enhancement** provided by the current fragmentation of the crowd, and roof proximity to the more populated/vociferous lower tiers.

The "Required" Capacity is difficult to establish with any level of confidence, at one end of the spectrum the optimist would say build it and the fans will turn up. The realistic approach looking at trends, average and peak attendances over a long period would probably be more cautionary. 50,000 is seen by many as an arbitrary minimum required capacity to accommodate a successful Everton FC's support, 55,000 a little more aspiring, allowing for some growth in the future if/when success is achieved, and/or to create potential economies of scale in construction terms. It should be noted that since the Taylor report there have been several clubs embarrassed by their initial estimation of "required capacity," many have subsequently needed very costly expansions, or even ground moves to satisfy their actual demand. **Therefore for the purpose of this design process the minimum capacity will be of the order of 50,000.**

In my opinion, there are essentially two separate approaches that can be adopted for the redevelopment of the current site and to address some of the issues raised:

1. **Quick fix** to get a reasonable capacity increase in the shortest possible time to increase revenue as a short-medium term solution.
2. A **phased holistic approach**, with a view to increasing the capacity and improving the facilities throughout the stadium over a series of stages.

The **Quick-fix**: several commentators on the subject have suggested that we should first erect a second tier on the current park end stand or to simply continue it back a further 20-40 rows. This would appear to be the simplest and most readily attainable solution, and indeed it would instantly yield 3-8000 extra seats dependent on the depth of this extension and/or corner development. This new end stand could potentially be larger than the current Kop in capacity and certainly in height, and would greatly boost the atmosphere, being something akin to the South Tribune at Borussia Dortmund's Westfalen Stadium, or indeed the new proposed Kop. This basic extension could probably be achieved at a cost per seat of approx £1,500 per seat. The resultant capacity could be as high as 48,500 which is very close to the minimum perceived requirement. Expansion of the Bullens Road stand or mainstand side at a later date could generate the extra seats required. The other main benefit being the possible preservation of the two Leitch stands. Goodison is the only stadium to boast two of his double-decker stands, the awkward corner section adding to the sum of these significant historical parts. **There could be a case made for combining new and old by building anew on the other two sides to create a truly unique stadium.**

The **Holistic approach**: The most basic inspection of the overall site and the surrounding road geometry indicates possibly a **greater opportunity to fully exploit the space and the structures available** that would not be immediately available if we adopt the quick-fix solution shown above.

With a view to minimising costs **what, if anything can be salvaged from the existing ground? Where is there room for expansion and how best can this be utilised?**

The **Gwladys Street** and **Bullens Road** stands are approximately 70 and 80+ years old respectively, with the lower tiers in particular suffering from **many obstructed views**. There is also a significant wood content, though not structural and therefore replaceable if necessary. The Gwladys's Street stand's close proximity to a terraced street behind potentially limits expansion at this end, unless problematic planning permission is gained. There will also be height limits for new structures at this end due to natural light infringement. There are other issues such as shallow rake of lower Gwladys street (former terraced section) causing **relatively poor sight-lines, as well as narrow and limited concourse areas in both Leitch's upper stands**. In their favour however, the upper tiers could be re-roofed removing all their obstructed views, and it should be noted that these elevated stands do offer some excellent views of the pitch. Furthermore, the Bullens Road stand could have its entire lower tier re-profiled to form a single terrace stand going as far back as say the second row of supporting columns. This action would help preserve one of Leitch's classic structures and greatly reduce the number of obstructions on this side, but for little extra capacity (although it was once stated by the club that re-profiling could result in 1,500 new seats). Perhaps a price worth paying to preserve a stand that witnessed Dean's magical 60, and in so doing maintain a major contributor to the character of the stadium. These stands have strong iconographic quality, they are instantly recognisable, and this quality has real value which cannot be recreated easily if at all in a new structure.



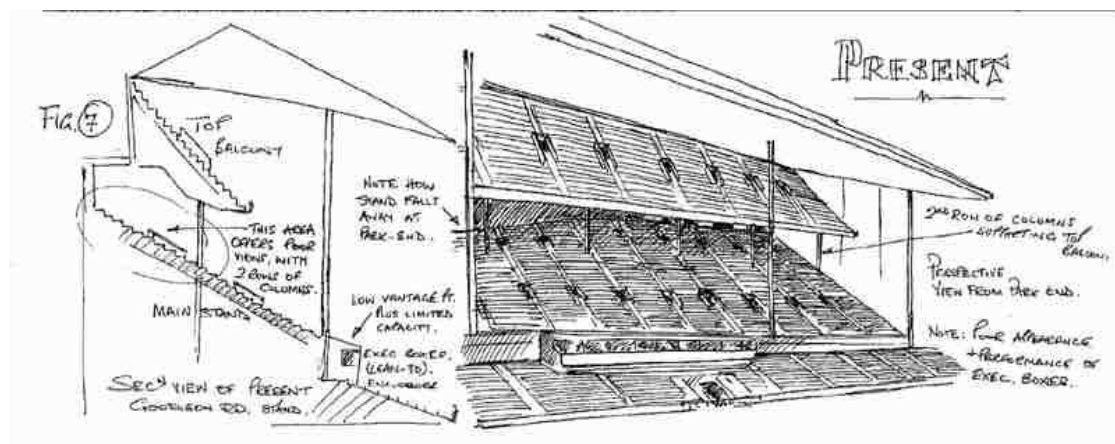
Dixie with the Bullens Rd stand as his backdrop.



Almost 40 year later (World cup semi-final)

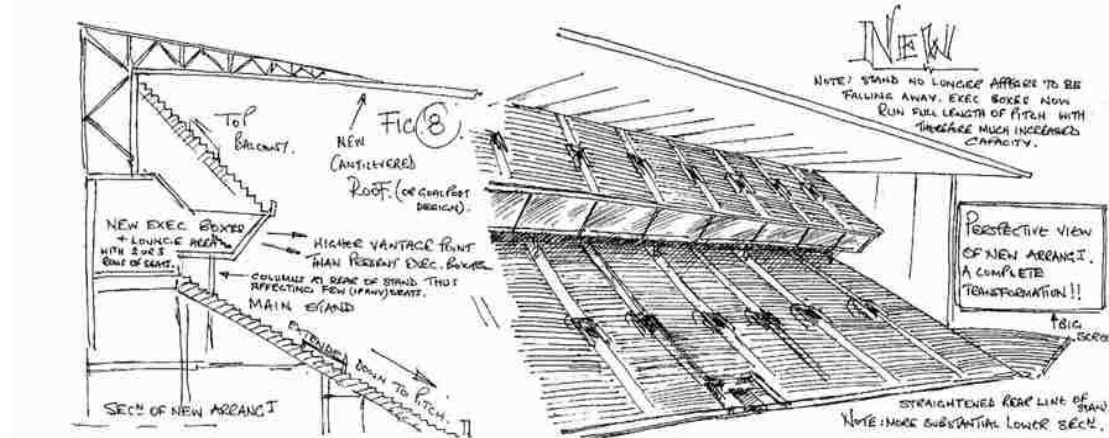
The current c-values for the rear rows of its upper tier would seem to limit much future expansion behind this structure as it is. Its preservation in its current position would also stop any transverse pitch movement, which is needed to improve the viewing performance of the top balcony. (See below)

The **Goodison Road side** is at first glance an eyesore with all its 1970's misgivings, however it has at least one redeeming feature, and that is its scale. I cannot overstate the importance of this attribute. Tall multi-tiered stands are synonymous with Everton Football club, and should form one parameter of any design brief, for several reasons, not least necessity borne from the site's restrictions. Its main failings are its misshapen configuration due the line of Goodison Road itself, and excessive obstructed views due to the two rows of supporting columns. (These Sketches are over 10 years old and are from: <http://easyweb.easynet.co.uk/~rilloyd/stadium.html> .)

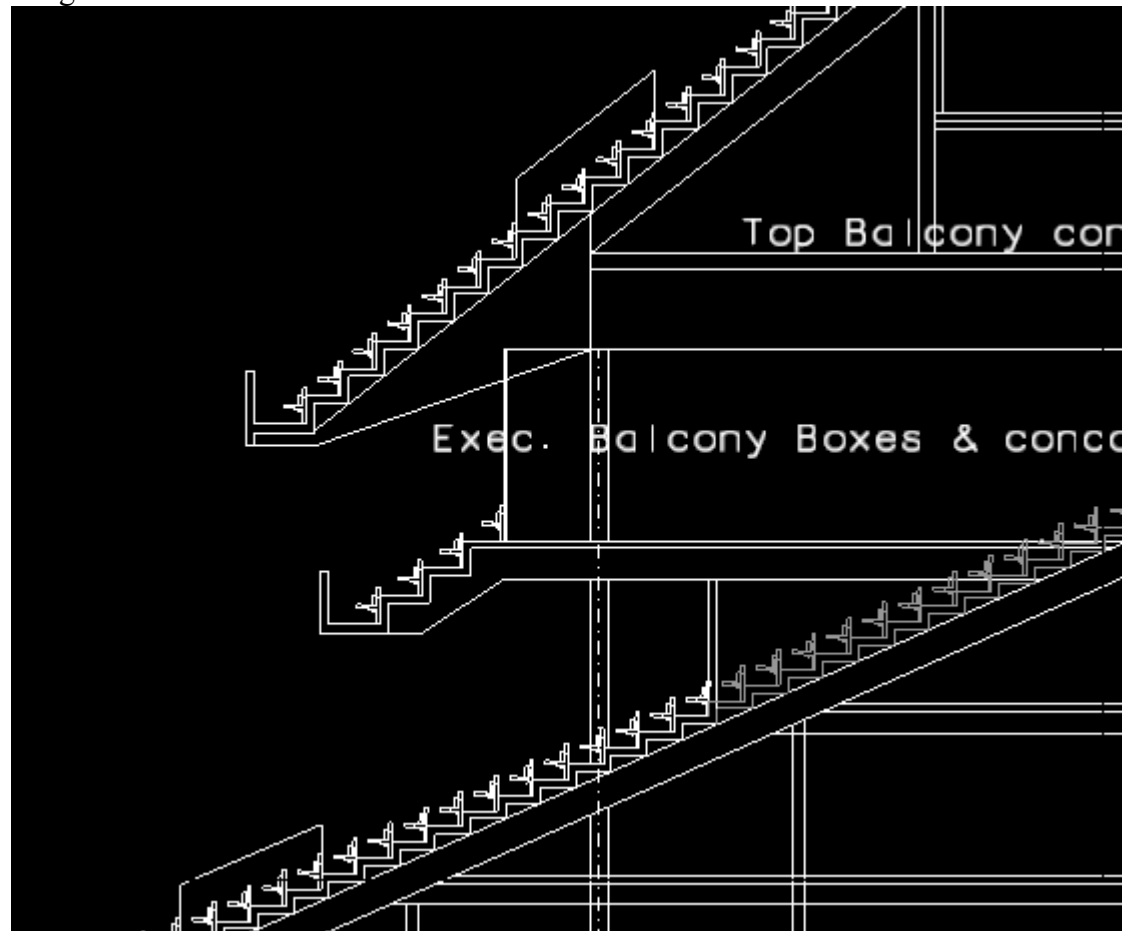


Some remodelling would show that this stand is not beyond redemption. It can be greatly improved in both appearance and function with these faults eradicated at a

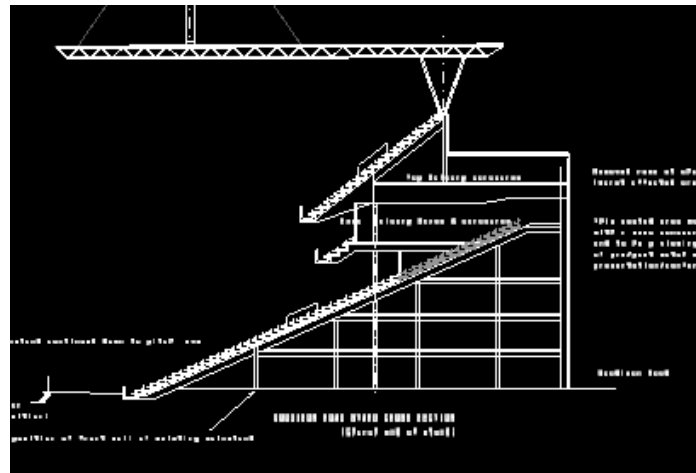
relatively low cost, first by removal of the roof and its supporting columns. Then secondly by the elimination of the majority of seating rows behind the second row of columns, most particularly at the church end of the mainstand.



This would then enable high quality executive boxes, or an executive tier (see cross sections below) to be suspended beneath the top balcony allowing the existing poorly situated lean-to boxes to be removed, thus restoring the full enclosure. The extra 4 rows of seats recently installed at the front of the mainstand may now be continued along its entire length, or alternatively the mainstand itself continued down to pitch level removing the relatively shallow raked enclosure altogether, and making this tier altogether more substantial.



Executive balcony inserted beneath Top Balcony (Note: redundant rows at this end of stand shown in grey)

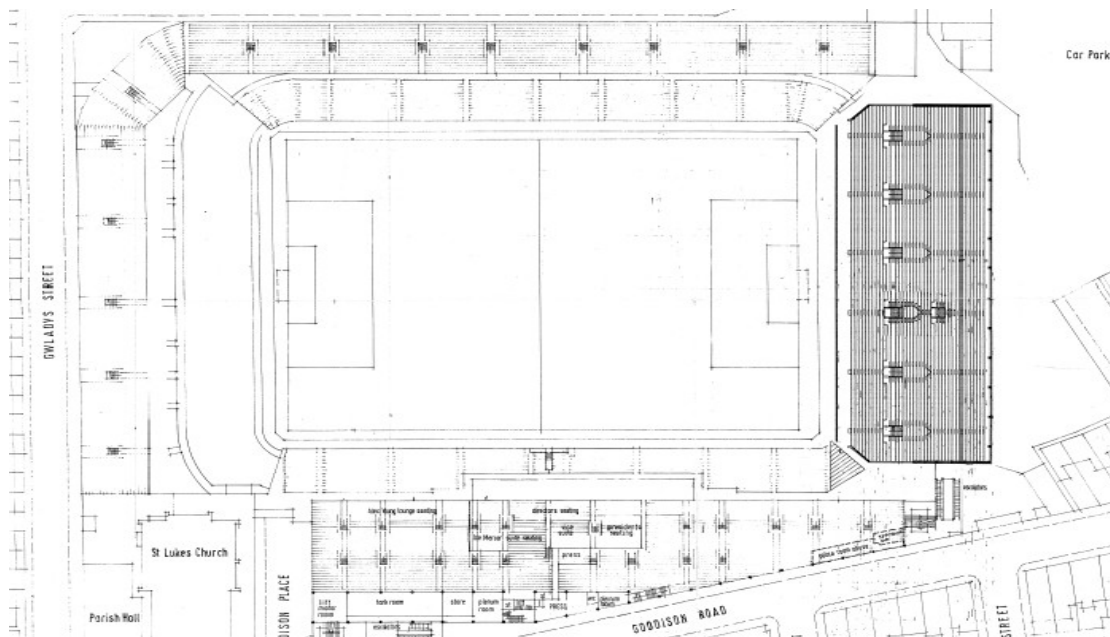


Mainstand cross section.

PITCH MOVE:

Manipulation of the pitch position can greatly free up space and/or improve the viewing performance of an existing stand. The remodelled mainstand and a pitch move of just 2-4 metres (Goodison Rd side to Bullens side) could create further capacity, offsetting losses incurred at the rear of the mainstand (church end) and generally improving sight-lines on this side. (See C-value comparison appendix) The overall effect is a brand new stand at minimal cost with substantially improved appearance and executive provision.

A further pitch movement along its longitudinal axis will have an even greater effect. The site plans (below) show the pitch is not central to the length of this stand.



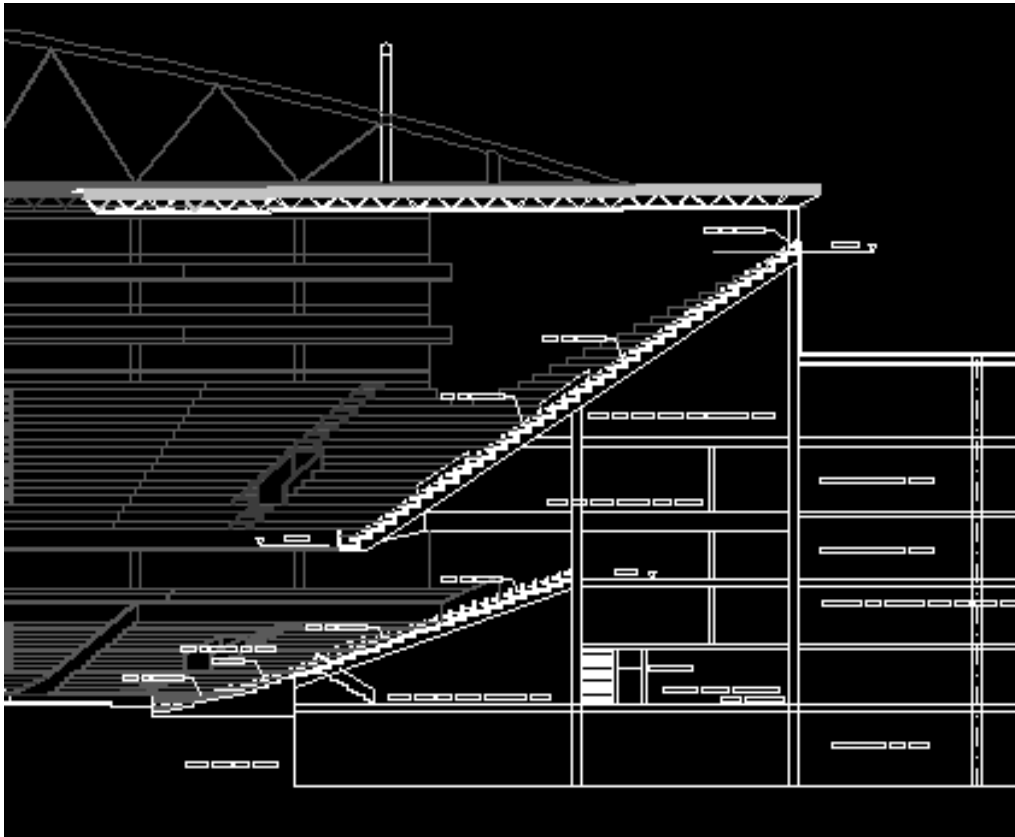
The Mainstand starts roughly in line with the 6 yard box (at the Gwladys St end of stand), ending approximately 20m beyond the Park end goal-line. Therefore, by moving the pitch 10-13metres towards the park end, this will centralise the playing area with respect to this stand, and more importantly open up valuable extra footprint for a new larger Gwladys Street end stand. This pitch-move will necessitate the removal of the current park stand, demonstrating the pitfalls the quick fix option and of simply putting a new tier on this stand which would forever limit the capacity at the New Gwladys street end, and therefore the ground as a whole (unless we have planning permission to remove the houses behind that stand). Centralising the pitch with respect to the mainstand will also improve the general performance of this side,

and further reduce the seated area loss due to St Luke's. In doing this, sufficient space will be freed up to allow a new and properly configured and continuous double-decker stand to be built in stages around the remaining 3 sides, completely enclosing the pitch in a horse-shoe. To achieve the sufficient depth on the Bullens road side, this road would need to be bridged, however the land-take and number of houses effected would be minimal, as only 2 streets abut this road. It may even be possible for the actual road to remain in place with the stand supported above. (Alternatively, simply two new end stands, meeting the mainstand at its corners and joining the Bullens Rd stand with curved or angled corner sections at their balconies thus preserving one Leitch stand and combining it with its new neighbours.)

With the height of all these new structures approximately matching that of the existing top balcony, a continuous roof would be erected covering all stands. The semi-redundant spaces either end of the mainstand will allow roof truss support towers in these 2 corners, minimising the spans and therefore cost of goalpost roof trusses if that is the chosen method of roof support. Catenary towers may be preferred. The holistic approach will result in the creation of a unified design to fully exploit the site. The aforementioned quick-fix will appeal to many, and my suggestion of removal of the newest stand may seem wasteful with such an apparently simple solution readily available. However, I would suggest that a simple referral to the quick-fix antics of our neighbours spending fortunes creating just 45,000 seats on a footprint that should comfortably yield 55,000, with as bad a set of ill-fitting adlib structures as you could wish to see as providing ample and sobering evidence of the pitfalls of such short-sighted policy. I also believe that the steps described optimise use of both the space and the structures available, representing the best solution for this site providing several complimentary solutions simultaneously.

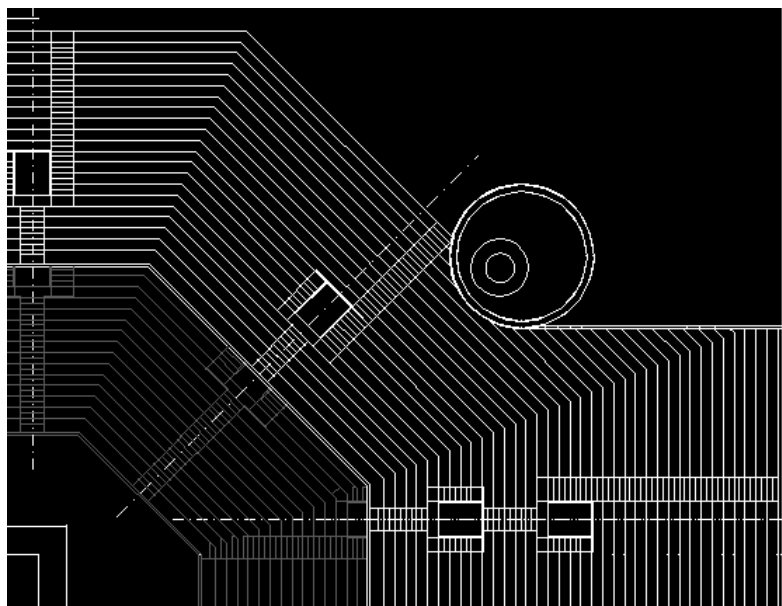
Design Ethos

Throughout the process there is one underpinning theme driving the design decisions. I feel that it is essential that the **new stadium should where possible reflect the stadium's history and appear as a natural progression**. By its nature, the site determines much of this by demanding a **multi-tier format**. The present configuration suffers in some respects in that the proportions are not really conducive to a good atmosphere generally. The stadium historian Simon Inglis refers to Goodison Park as a "special occasion" venue. The Grand Old Lady demands mass crowd participation for it to really resonate, however when this threshold is passed it is as intense as anywhere with everyone relatively close to the action. Generally however, the upper tiers are not really substantial enough (18-20 rows) to enhance the atmosphere on their own on the "not so special" occasion, and conversely the heavily populated and more vociferous lower tiers too distant from the high roof. To counter this within a double-decker configuration these proportions need to be changed dramatically, the new upper tier's depth/capacity is greatly increased (behind the goals). The new end stands upper tier will be of 37 rows above an also substantial 33 row lower tier (see cross section below). Also, the underside of the upper tier is marginally more distant from the lower stand's seating deck than with the existing arrangement at the Gwladys Street. This will enable more of the atmosphere generated under here to propagate out onto the pitch as opposed to being trapped as at present.

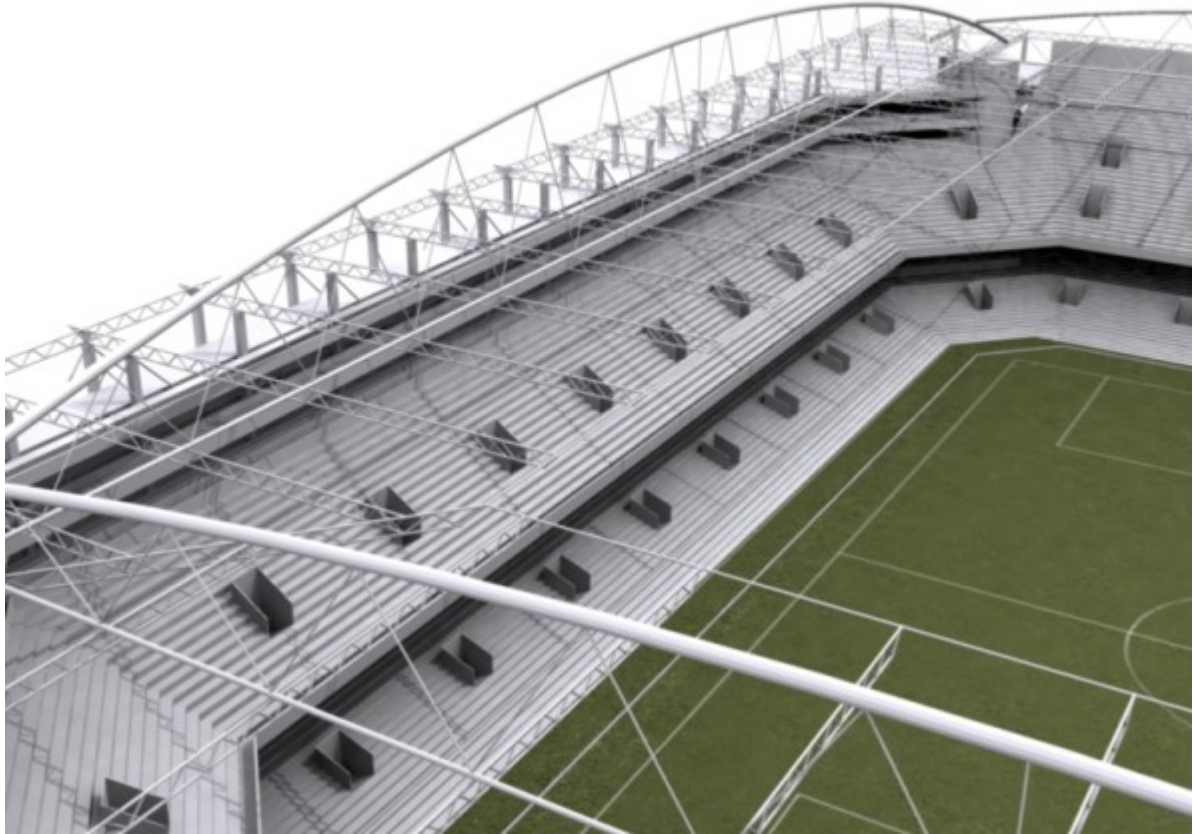


New Park end

This approach has the added benefits of creating a significantly greater number of high quality elevated views while at the same time maintaining a low average viewing distance compared to most new stadia. By comparison, on average the supporters will be much closer to the action, and with much superior viewing angles than at the new stadium in the park due to that venue's reliance on single or stepped single tiers with no real overlapping stands. The corner sections are produced by simply cranking the new tiered arrangement at the corners, as opposed to rotating them to form a segmented curve.



Corner section (Bullens Rd/Park end stand)



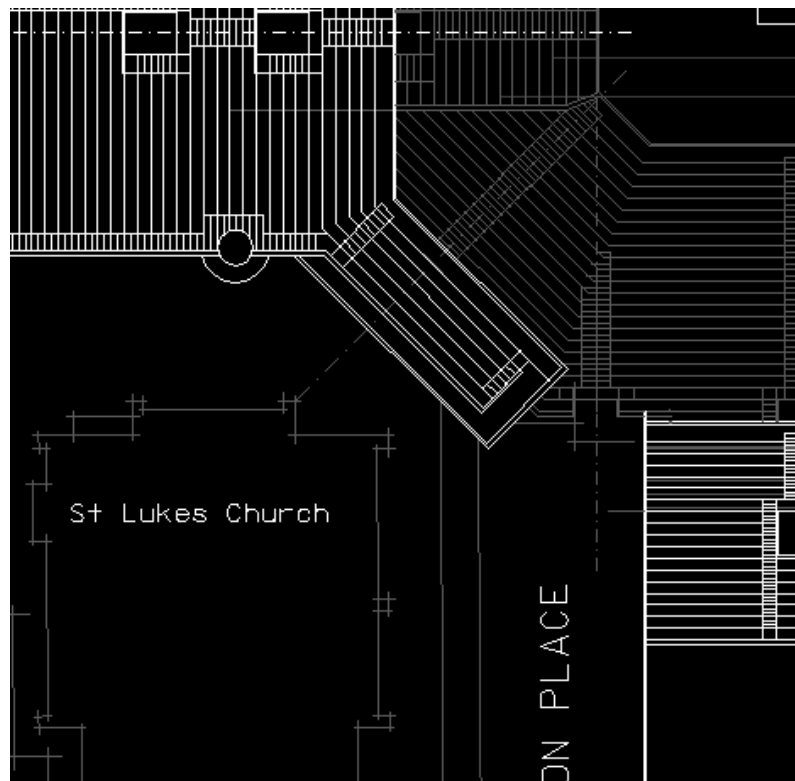
3-D CAD model Bullens Rd with corner sections clearly shown.

This approach has been adopted to reduce the traditionally high cost of corner sections due to the relative complexity of the structure usually required. This simple angled section also has an historical reference as regards the current corner arrangement (St End/Bullens Rd) further representing the natural progression theme. Regular structural elements are where possible standardised to facilitate cheaper mass pre-fabrication thus greatly reducing material/construction costs. It should be noted that Liverpool have commendably revised their plans to centre around the new Kop.

This redevelopment plan focuses on creating a certain unity between the stands which has been a trademark of our stadium since the upper Gwladys Street was completed in 1938 to give 4 double-decker stands (This need not mean complete symmetry). This is achieved by the continuous balcony around 3 sides of the horseshoe, the roofline around all 4 sides and the method adopted for knitting into the mainstand side. The lower tier on this side will now be more reminiscent of the vast Goodison Road terrace that once sat beneath, to give yet another connection with the past.

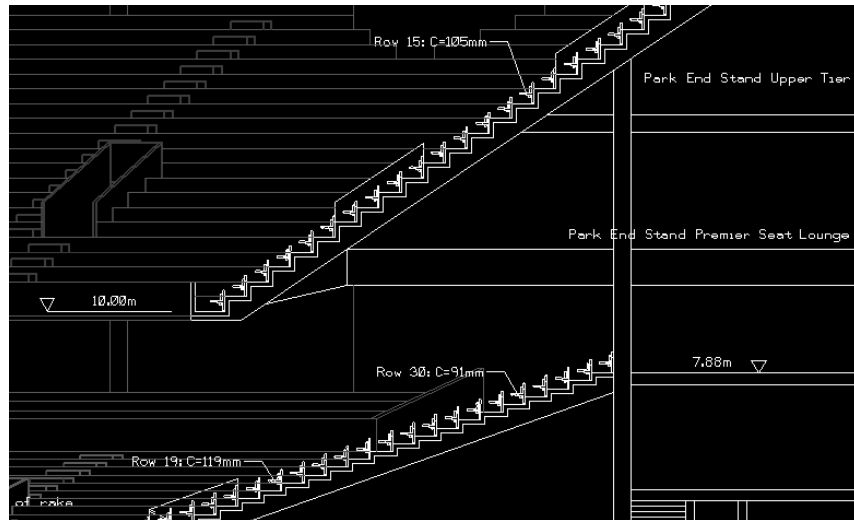


3-D model: Corner Section (New Gwladys St/ Mainstand side)



Corner Section (New Gwladys St/ Mainstand side)

The configuration adopted, being multi-tier allows much greater flexibility in terms of price structuring to suit the full Evertonian demographic. We are constantly informed that the executive/commercial provision is insufficient and inadequate at Goodison. I also believe that there should be plentiful provision at the other end of the scale, as these potential customers (excuse the term) may number in their tens of thousands and should not be priced out. Therefore, I have shown how the tiers can be split to broaden the price range, offering excellent, TV gantry quality views and spacious and well appointed concourse areas for those prepared to pay for that. Also, the front rows of the upper tiers at the end stands may also have their own lounge areas to add to their high c-valued sightlines, thus offering strong mark-up potential in these areas also.

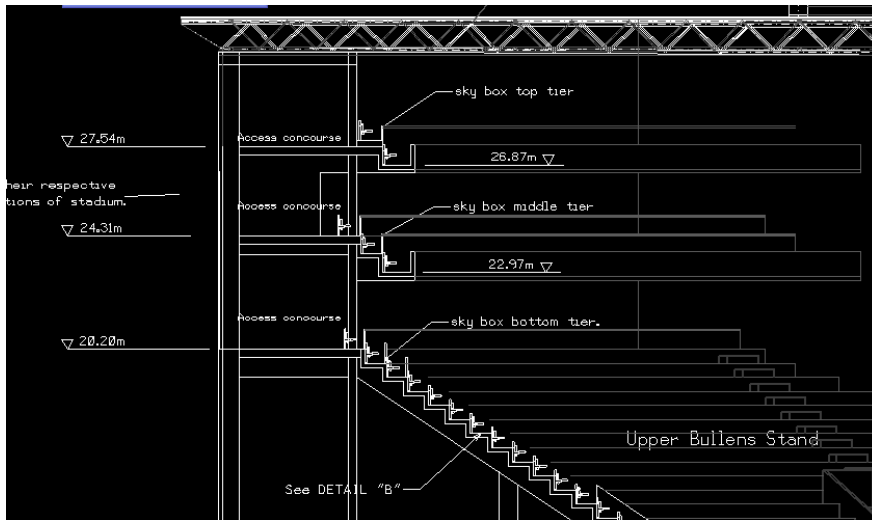


Above & below: Park end stand (showing premier seating in front 10-14 rows with dedicated lounge)



3-D CAD model: Park end stand. Note: two rows of exits.

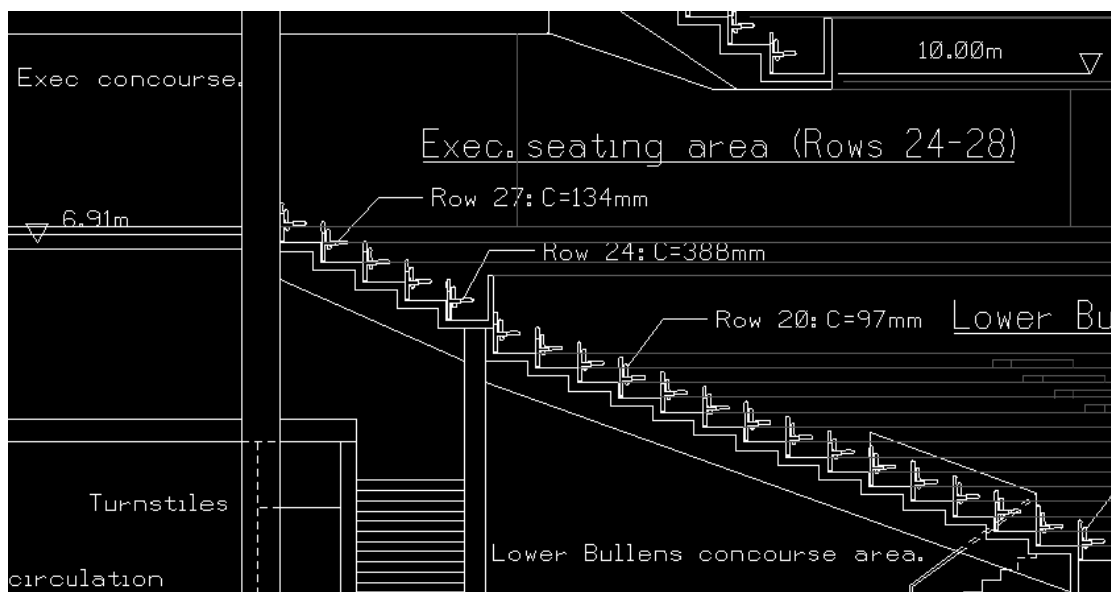
This would be far more suitable than the current arrangement at say... the Park-end lounge area where the patrons hardly enjoy quantifiably better views than those in the rest of this stand other than being central. The relatively broad high earning potential of these executive and premier seated areas could allow for a really competitive pricing strategy in the rear sections of the upper end stands as well as the lower stands, ensuring that the more vociferous fans are tempted to take up their views directly beneath the roof. Also, given the new technology as regards “smart tickets” and computer controlled turnstiles, there may also be potential for unreserved sections to help stimulate terrace style interaction where fans congregate on the stands earlier, at their own discretion and with their own friends. These areas could also have smaller tread depths prompting higher densities in these areas, and greater capacity. Many new stadia have completely failed to replicate these elements of terrace-culture, and these simple design details could form part of a strategy to do so. The **Executive provision** is achieved on both sides and is **at different elevated positions** to offer a variation for different preferences, and indeed a broader price range within this bracket.



Skybox Exec/premier seating on 3 levels on Bullens Rd side. Showing how these mini tiers follow the line of the upper tier around the corner section terminating at the truss supporting towers.



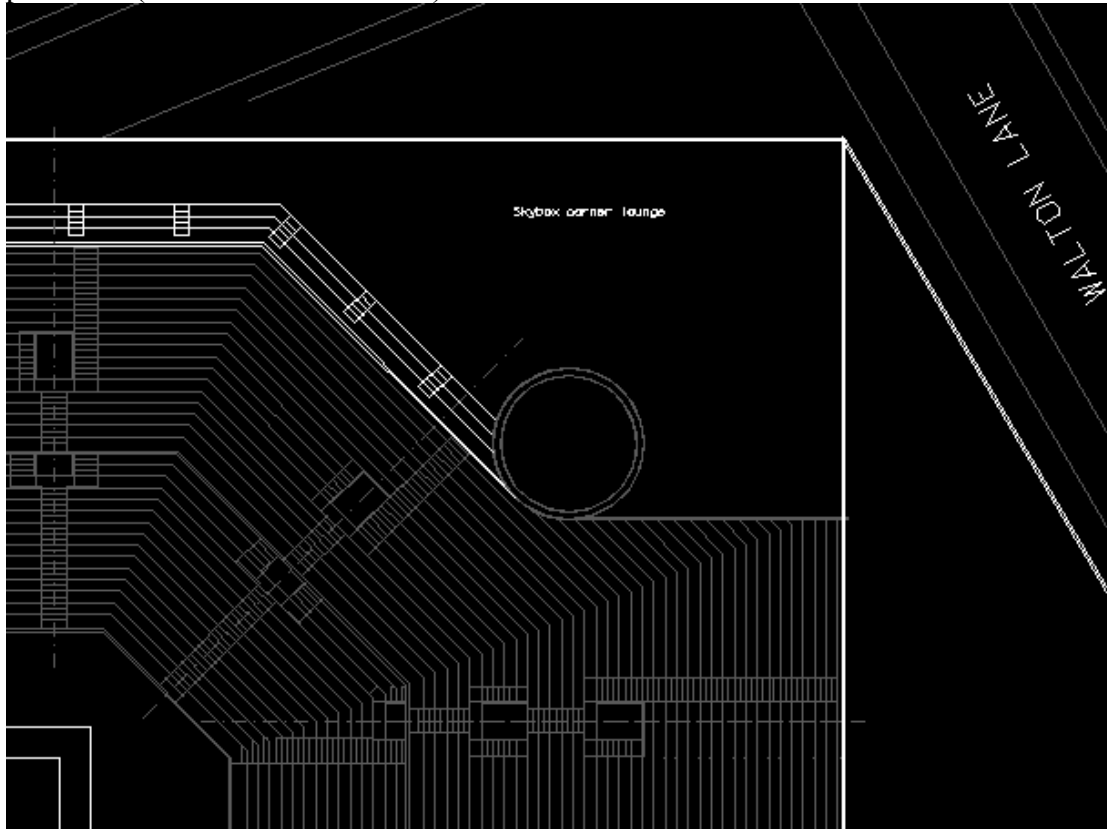
Disabled fans will also be able to access areas such as the lower Bullens exec area, with proper elevated views as opposed to the current pitch-side only for wheelchair users. Corner sections may be adopted specifically for this to offer panoramic views.



Lower Bullens Exec area (also possible disabled section)

In these locations, the view will be unobstructed even when fans in front are standing.

The corner lounge areas on the Bullens Road side are fundamental to the viability of these skybox tiers and work also to square off the overall plan representing efficient use of space often poorly utilised at stadia. These also represent in effect six separate lounges with direct views of the pitch, which will have non-matchday revenue potential. (Functions/conferences)



Rectangular layout showing corner lounge/bar areas. These may have function room capability, and as there are 3 levels will represent a 6 room facility, all with views of the stadium

Proposed phases

Goodison Park current capacity 40,500

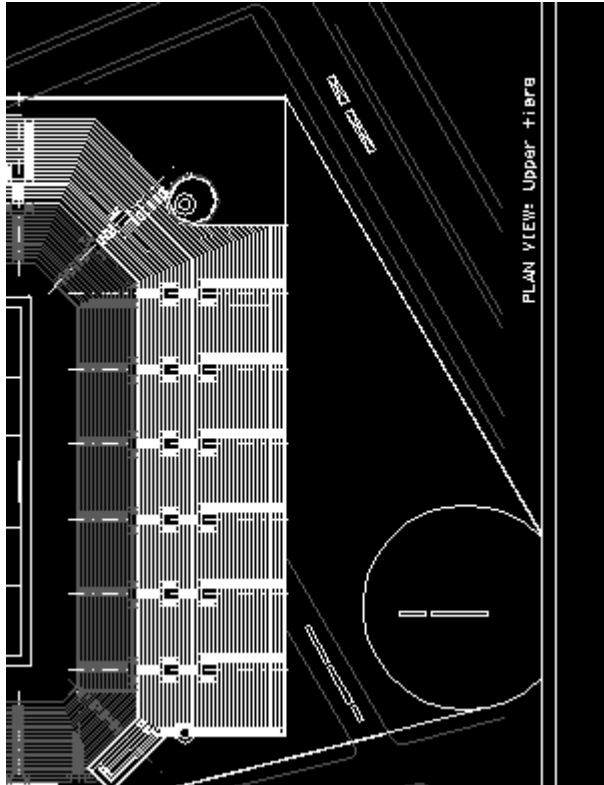
PHASE 1: Demolition of Park Stand and reconstruction of lower tier in close season.

Capacity: 40,030

Upper tier completed within further 5 months:

Capacity: 46,616 (not including upper tier corner section, to be commissioned at final stage)

Plan view

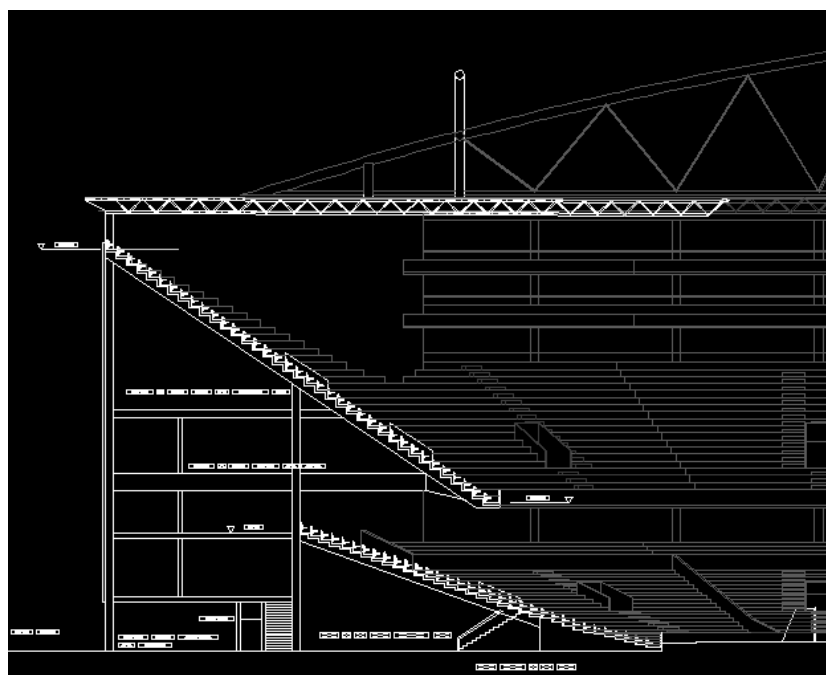


PHASE 2: Demolition of Gwladys Street Stand and construction of Lower tier in close season.

Capacity: 40,761

Upper tier completed within further 5 months.

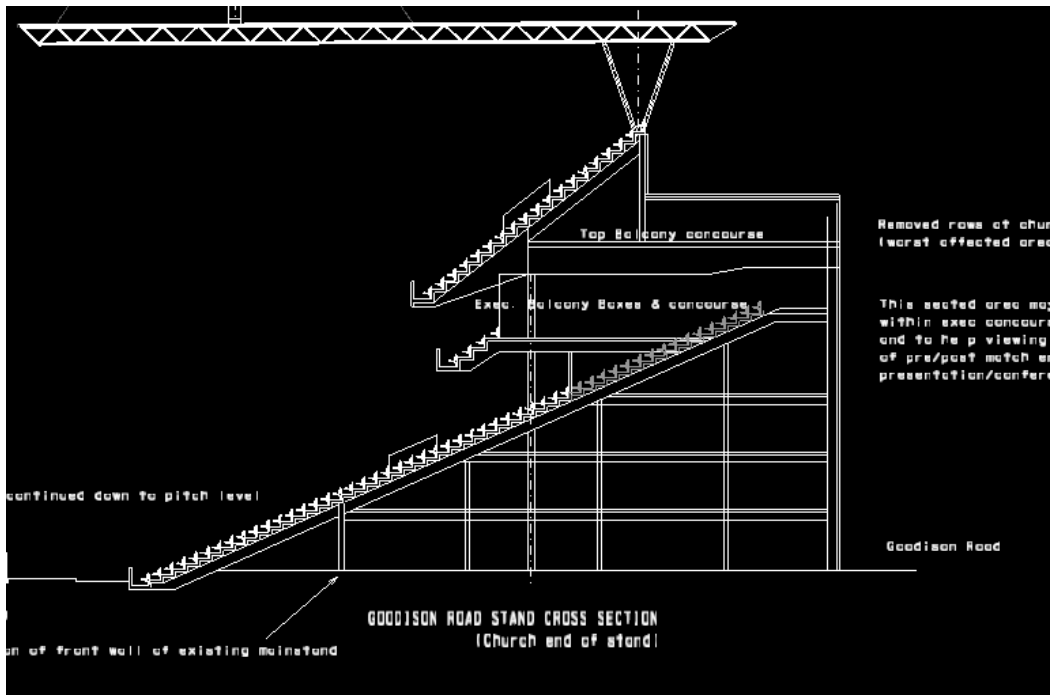
Capacity: 47,347 (not including corner upper and lower tier section, which will be commissioned at final stage)



New Gwladys Street stand

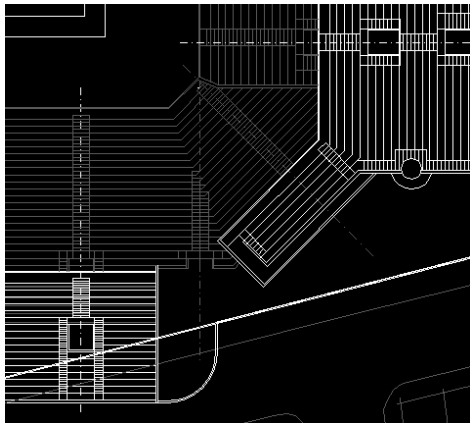
PHASE 3: Remodelling of mainstand:

New Exec balcony suspended beneath existing Top Balcony. Loss of seating beyond supporting columns.

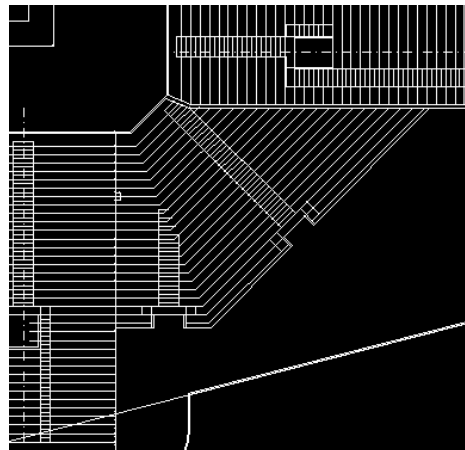


Mainstand with new roof, stand continued down to pitch level, executive tier inserted beneath Top Balcony, and rearmost rows of mainstand (church end) removed.

New Lower tier corner sections completed simultaneously. (See below)



Goodison Rd side corner section showing small upper tier in place.



Corner section (lower tier only)

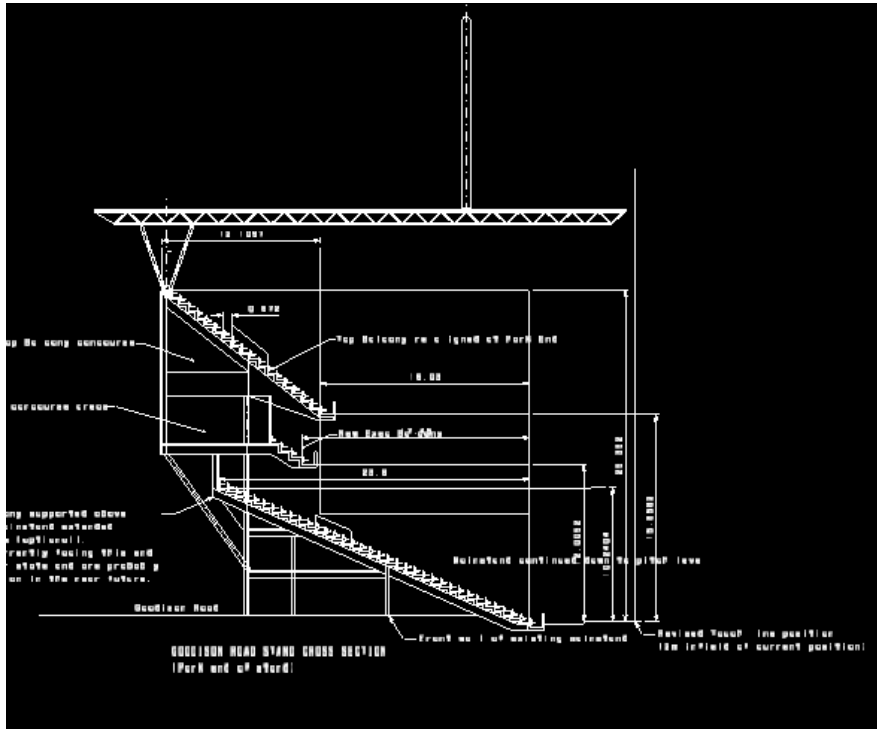
The Top Balcony straightened and supported above Goodison Rd. The units opposite are semi-derelict and mostly vacant.



Straightened Top Balcony (at Park end of stand)



Corner Panelling may be solid or glazed. With TV screen mounted (not shown). (Roof shown transparent)



Mainstand supported over Goodison Rd

Whilst not essential to straighten this upper stand, not to do so would mean a further requirement for lateral movement of pitch across field towards the Bullens to ensure adequate view of near corner from this otherwise cranked section.

Capacity: 49,549

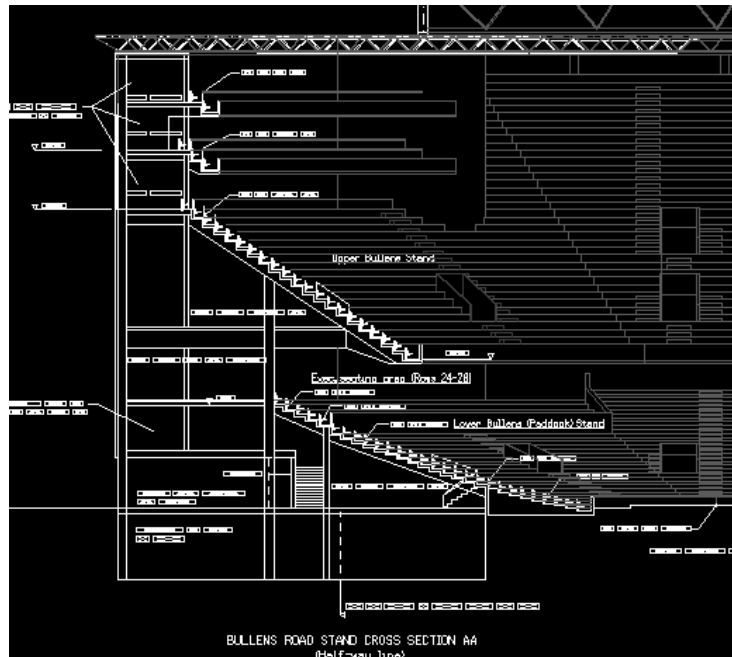
PHASE 4: Bullens Road side two options:

- Preserve Bullens Road stand with new corner sections joining new end stands. Re-profiling lower tier into one single raked terrace stand with no loss in total capacity on this side.
- Continue new end stand around corners and along Bullens Rd side.

Option 1 could include the provision of a new exec Balcony above the rear of the existing Upper Bullens as part of the new roof construction. This would be a simple 2-4 rows of seats with access walkway at its rear, and would greatly improve exec/premier seat provision increasing capacity by 600-1,200.

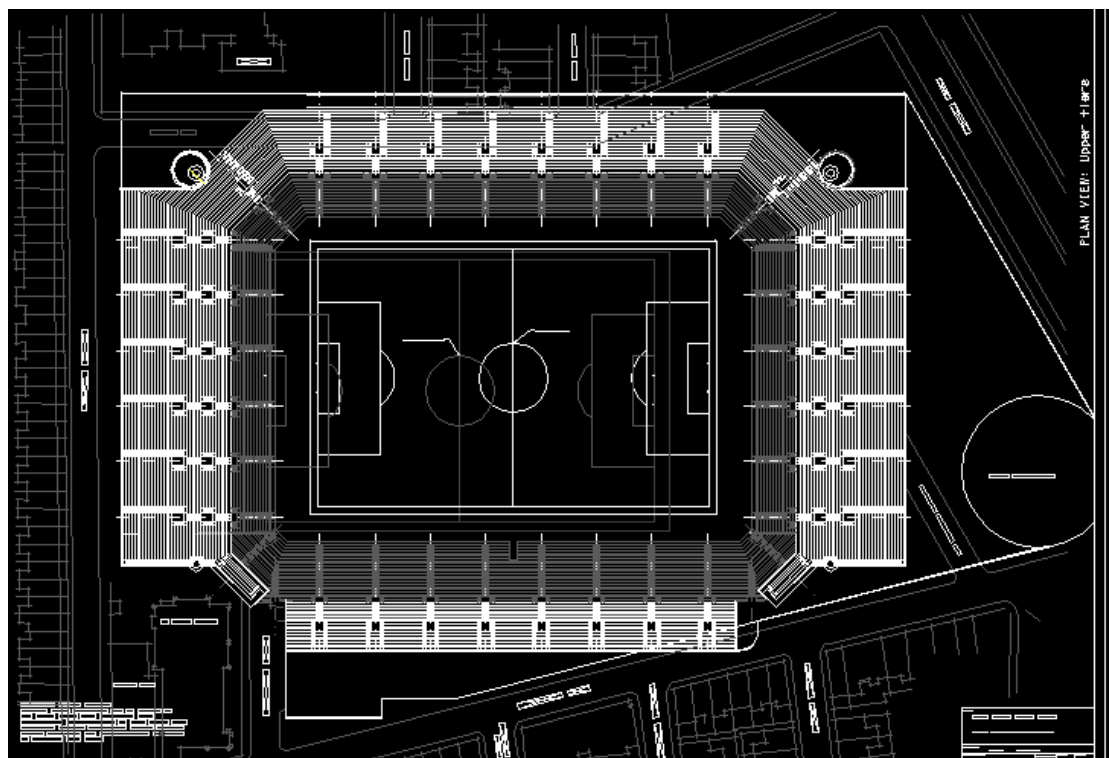
Option 1, Capacity: 52,600-53,200

Option 2, as depicted below:

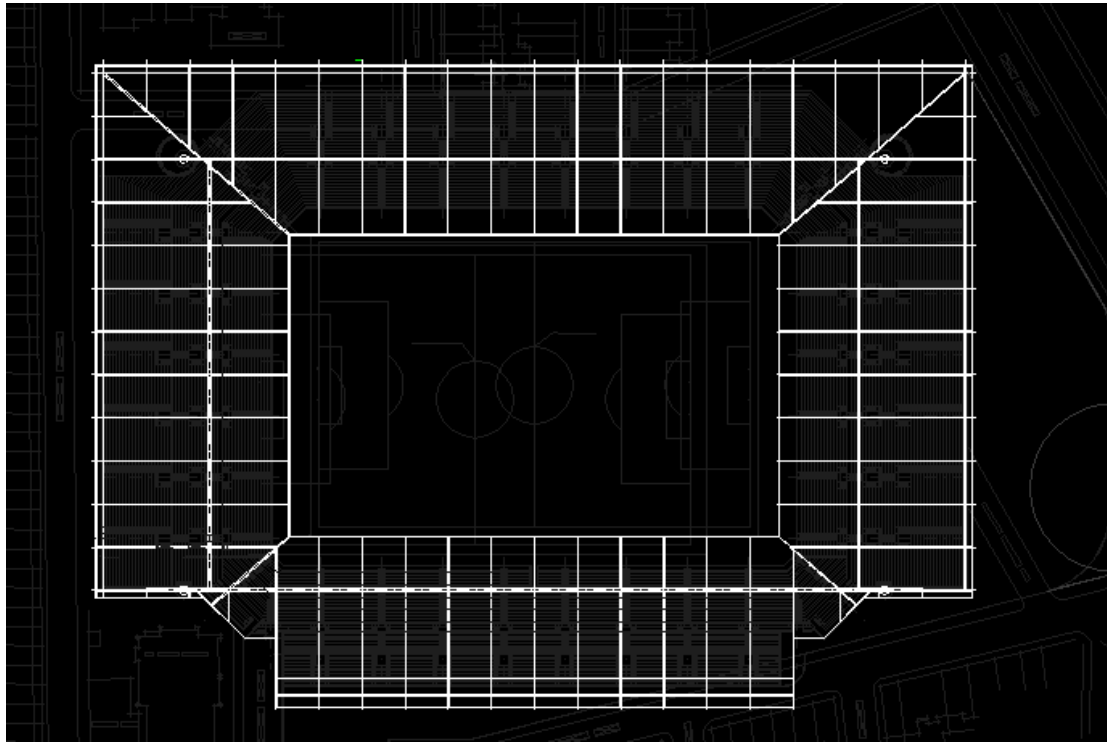


New Bullens Rd Stand Cross section

would allow the continuation of the roof around this final side to be completed. The continuous upper tier balcony, combined with roof line around these 3 sides would create an enclosed unity that will compliment and frame the mainstand side, which will blend into it at the lower tier corner sections. The horseshoe configuration is one favoured by many of the great stadia around the world; it lends a certain exclusivity to one side breaking the monotony of the symmetrical bowl.



Plan view showing pitch move and positioning of new stands around remodelled Goodison Rd side



Full roof Plan view

Phase 4 option 2: Demolition of Bullens Rd stand and reconstruction of lower tier and its corner sections, and upper tier corner section at Gwladly Street end.

Capacity: 49,327

Upper tier completed in further 5 months and new Sky box levels installed:

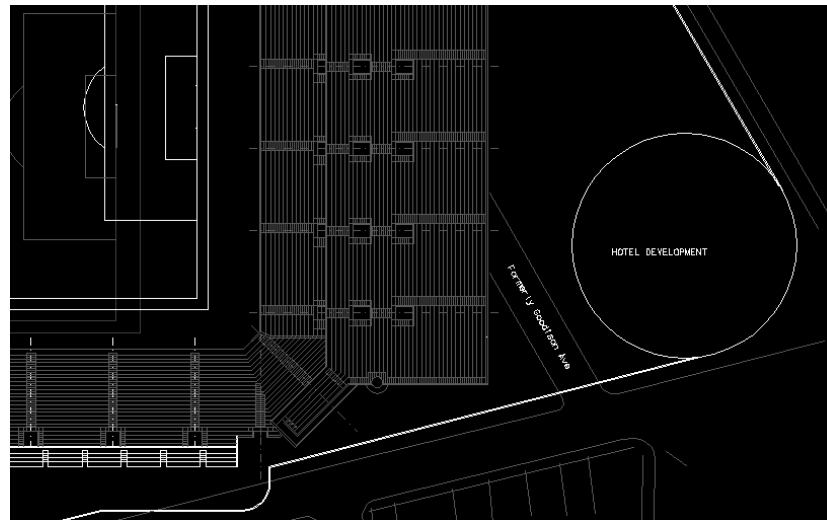
Capacity: 56,982

It should be noted that this capacity is achieved with the footprint expansion shown. If a larger land take is possible a slight modification of stand profile and the ensuing increased depth can yield significantly larger capacity. Furthermore, any significant increase in land take may result in the adoption of a different roof support technique enabling greater utilisation of corners and consequent capacity increase in those directions also.

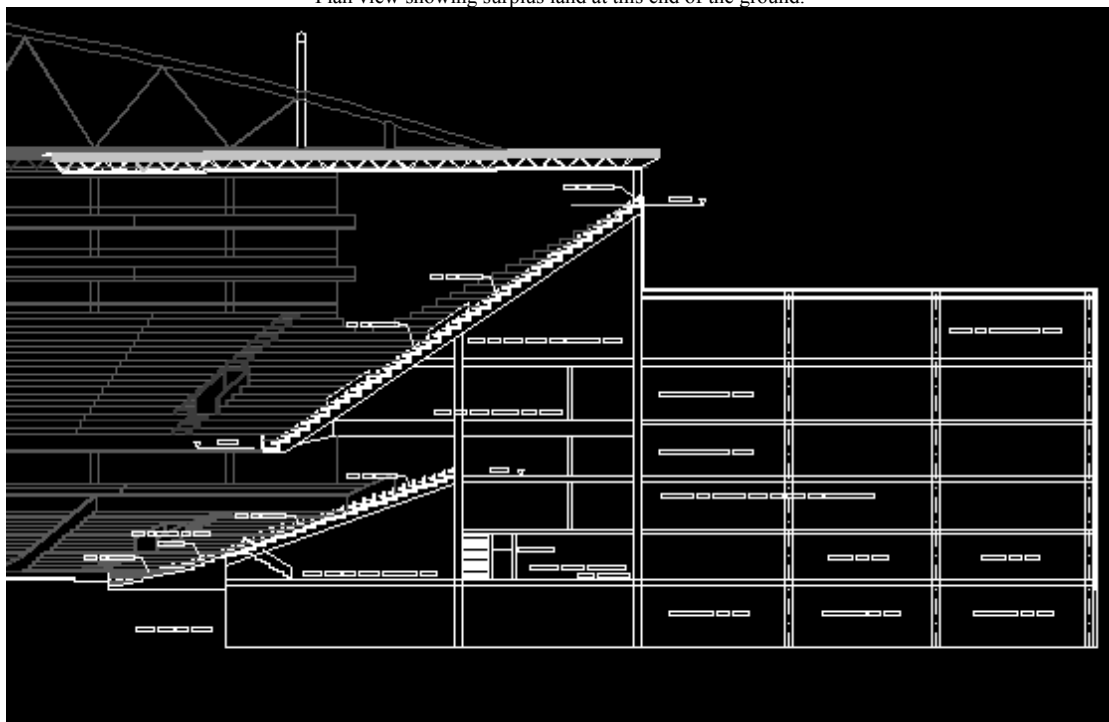
This is just one iteration to fit the extended site, there are a multitude of variations that can be manipulated within the current boundaries or reasonably expanded ones.

STADIUM EXTERIOR/FAÇADE

As I am not an architect the stadium frontage shown is only a token effort on my part, personally I favour a minimalist approach to the façade with the stress on the quality of the interior both aesthetically and functionally as a viewing and atmosphere enhancing platform. However, given the historical context of the site, there may be an opportunity to create a real architectural signature or statement behind the new Park stand structures, making full use of this important landmark position fronting the main thoroughfare of Walton Lane.



Plan view showing surplus land at this end of the ground.



New Park end stand cross section. Note underground and multi-storey car park. (Hotel development not shown)

This could even follow well after the main structures are completed and in operation. Alternatively, this prominent corner site will attract an investor for a hotel/apartment development to partially or even fully fund the redevelopment of this end of the ground in the first phase. Football tourism is a growing Industry, and with the New Anfield in the same vicinity, and the ever increasing demand for Hotel Rooms in Liverpool this could be viable. This block could perhaps incorporate a Retro-Leitch brick façade built using reclaimed bricks from his old stands. This approach has been followed at many new American Football and Baseball stadia with various levels of success, and could really lift this development in terms of Architectural status. (see below)

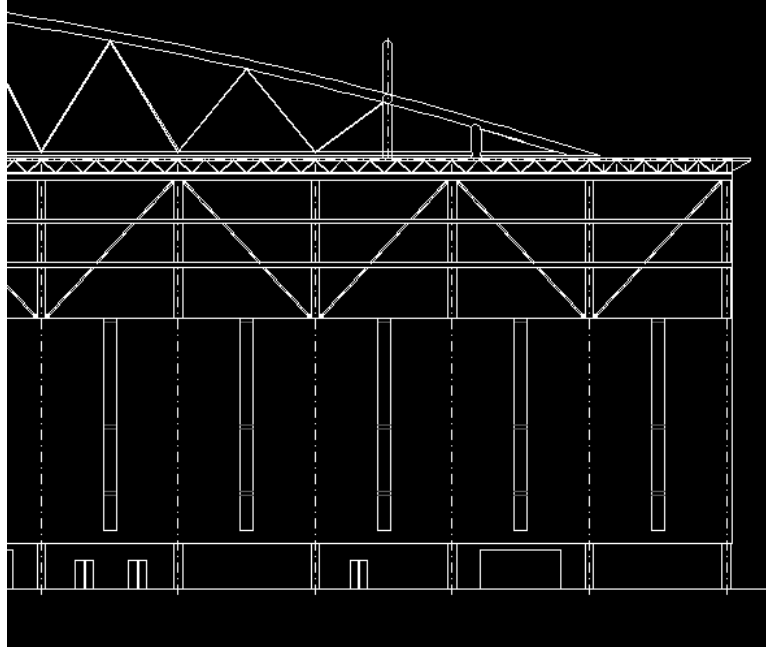


(Oriole Park at Camden Yards Baltimore Maryland, USA)



Coors field Denver Colorado, USA

As an internal detail Leitch's original distinctive balcony wall from the upper Bulls could be reused throughout the stadium for retail/bar frontages, or as decorative wall panelling in selected areas. Although, I would on a personal note be wary of re-using them as balcony walls as this may be pastiche and cheapen their effect (which is only my opinion). In the new Bulls Road elevations, there is a strong use of transparent panelling at the rear wall of Skybox levels.



Bullens Road façade (suggestion) Exposed steel frame with diagonal bracing inside glazed panelling.



3-D CAD model: From inside: Sky boxes shown unglazed.

This is twofold in purpose, the natural light will benefit both these concourse levels and the pitch, it will also allow for some visual exposure of the structure which is slightly reflective of Leitch's work also. At Ground level a covered external concourse is formed on the three new sides with a line of railings/gateways acting as the only exposed surface (except on the Goodison Road side). These will slide open on matchdays to allow circulation, and for queues to form under cover (no more waiting for those cup tickets in the rain)

Goodison Park..... the Natural progression:

Given the historical importance of the site, I felt that it needed to be treated with at least one eye on the nostalgic. In saying this I don't mean nostalgia for nostalgia's sake nor sentimentality. However, the historical context, indeed the tradition also

promotes modernity, with EFC continually at the forefront of stadium development up to the final quarter of the last century. **Therefore, I feel the interior arrangement of the tiers and their positioning and negotiation of corners represents a natural evolution of Goodison Park**, as were all previous additions (except the park end). Any Leitchesque brick-arched and glazed façade could perhaps use bricks reclaimed from the existing Gwladys street and Bullens Road stands, should they be replaced. This would combine to give a strong connection with the past providing a monumental frontage to the main Walton Lane thoroughfare passing the site. The simple clean minimalist exterior of the main body will be balanced by the traditionalist hub/architectural statement at the park end. This will contain most of the new administration areas further focusing the functionality of the main structure as a viewing platform, with its rather Spartan simplicity hinting at something special on the inside. Design of both this façade and signage whilst retro in style should not be a token gesture but either an accurate and faithful reproduction of Leitch's work or a strong contemporary impression encasing traditional Everton imagery. The result could be the most traditional yet modern Football stadium in the country, which is surely only right for the site and Football club in question. The cavernous interior will have greater physical presence than any club stadium in the country, possessing the apparent scale of one of the European superstadia..... The most natural and seamless progression, the literal rebirth of Toffeopolis for all future generations of Evertonians.

“The spirit, the camaraderie and the atmosphere of a great sporting event are enhanced by a great stadium. The venue is not a passive backdrop, but a set which intensifies the drama of the occasion” Rod Sheard (Stadia pg 138, Periplus 2006)

SUMMARY

This is an outline Design Concept, a preliminary stage in the design process. It is however the result of many attempts using a sightline modeller to arrange various tiers of seats around the confined site. In explaining the decisions I have taken, I hope that I have illustrated the thought processes that have led to the design shown. It is by no means the finished article, as an individual I have not the time nor resources to generate such, but an attempt to highlight the potential of this site by way of an example, which in my opinion as an Evertonian interested in stadium design could form the basis for a fuller exploration of the site. There is much about it that I would probably change already; such is the nature of design. However, given the urgency and imminent vote it is important that I at least finalise this first iterative rendering. In doing so I hope that it arouses Evertonian's imaginations as to the possibilities of either transforming 2 existing stands and building 2 new end stands, keeping both Leitch stands and placing 2 new contemporary structures on the other 2 sides, or alternatively as illustrated creating 3 new stands in a horse-shoe to adjoin the existing but updated mainstand side. I hope that the drawings and images show that this need not be an adlibbed solution, but a genuine modern design in both form and function.

There are potential reservations and planning issues regarding infringement issues. Bridging the Bullens Road as shown instantly interferes with the immediate end terraces (4-5 in number). Taking increased shading due to a taller structure into account, this could then affect a total of 10-15 houses on this side. The Gwladys street stand as shown is also significantly higher than the current structure. Some manipulation, i.e. shortening the depth of stand at this end, or indeed a combination of this and slight movement further towards the Park end could provide a workable

solution at this end if the light infringement issue cannot be negotiated with residents. Regardless, the loss in capacity at this end would not be more than 1,800 seats for full compliance, and this can be readily reclaimed at the Park end of the ground with relatively minor adjustment and extension of tiers at that end. Another issue, (though by no means a necessity) may be the church hall could be obtained to widen the access to this end of Gwladys Street. The pathway around these new stands will already increase the access width by a greater proportion than the increase in capacity. Alternative free hall facilities could then be granted to the church in a dedicated St Luke's Lounge in the stands for which they would never need to cover maintenance costs etc.



3-D CAD model: Aerial view, showing rear of mainstand and facing Gwladys Street and Bullens Rd Stands. Note no external detail or ancillary buildings shown at this stage.

A COMPARISON:

This stadium will be a completely enclosed arena (not covered, although this is also feasible), with all the characteristics of the large Spanish and Italian superstadia. Though enclosed it respects the individuality of each stand with symmetry only on the transverse axis thus breaking the monotony of a basic bowl. The Capacity is almost 57,000 seats. There is room for expansion at the Park end stand, and or by completely removing Top Balcony to bridge Goodison Road, or by a further land take on the Bullens Road side or indeed my manipulating tread depths in different sections. 65,000+ would be readily achieved by any of these methods. This configuration has a far greater intimacy than the Kirkby proposals and is a made-to-measure solution, with neatly fitting stands as opposed to the "off-the-shelf", basic stepped 2 tier standard arrangement shown for Kirkby. On average all upper tier seats for similar heights in this scheme will be 10-15m closer to the pitch, with consequently improved viewing angles, and more than ample sight-line c-values (see below). There is a combined provision for up to 11,000 executive and premier seats, as well as extensive lounge and concourse areas. Viewing angles for the majority of the 60-70 boxes are in much superior elevated positions to those of the Kirkby proposal with similar viewing distances. As at present, this stadium will possess two home ends. These stands

represent an enhancement of the current double-decker format with greater capacity, superior acoustics and propensity to encourage a great atmosphere. The tall cavernous arena will represent the most unified yet traditional stadium in the country, and a direct evolution of Goodison Park.

The Home Of Everton Football Club.

Appendix:

Capacities

| | seat width | No of rows | Aisle width | Aisles No | sts in row | Capacity |
|--------------------------------|------------|------------|-------------|-----------|------------|--------------|
| Bullens up | 0.465 | 21 | 1.5 | 9 | 241 | 5061 |
| Bullens low | 0.465 | 23 | 1.5 | 8 | 224 | 5152 |
| St End up | 0.465 | 37 | 1.5 | 7 | 178 | 6586 |
| Park end up | 0.465 | 37 | 1.5 | 7 | 178 | 6586 |
| St End low | 0.46 | 34 | 1.5 | 6 | 153 | 5202 |
| Park end low | 0.46 | 34 | 1.5 | 6 | 153 | 5202 |
| Top Balcony | 0.46 | 19 | 1.2 | 9 | 234 | 4446 |
| Mainstand rear | 0.46 | 16 | 1.2 | 9 | 234 | 3744 |
| Mainstand front | 0.46 | 19 | 1.2 | 12 | 308 | 5852 |
| Exec balc | 0.5 | 4 | 0.9 | 18 | 204 | 816 |
| Bullens sky box | 0.465 | 7 | 1.5 | 13 | 334 | 2338 |
| Bullens/parkend lower corner | 0.46 | 23 | 1.5 | 2 | 36 | 828 |
| Bullens/Gwladys lower corner | 0.46 | 23 | 1.5 | 2 | 36 | 828 |
| Bullens/park end upper corner | 0.465 | 21 | 1.5 | 2 | 55 | 1235 |
| Bullens/Gwladys upper corner | 0.465 | 21 | 1.5 | 2 | 55 | 1235 |
| Bullens lower exec | 0.5 | 5 | 1 | 23 | 319 | 1595 |
| Parkend/mainstand upper corner | 0.465 | 6 | 1 | 2 | 23 | 138 |
| Gwladys/mainstand upper corner | 0.465 | 6 | 1 | 2 | 23 | 138 |
| Total Capacity | | | | | | 56982 |

C-Value Assessment of existing Goodison Rd side with current pitch position.

Top Balcony Assessment

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|------|-------|-------|-------|----------|--------|----------|
| 1 | 0.53 | 0.672 | 17.04 | 15.84 | 38.26251 | 22.08 | |
| 2 | 0.53 | 0.672 | 17.57 | 16.37 | 38.26251 | 22.752 | 0.010738 |
| 3 | 0.53 | 0.672 | 18.1 | 16.9 | 38.26251 | 23.424 | 0.010438 |
| 4 | 0.53 | 0.672 | 18.63 | 17.43 | 38.26251 | 24.096 | 0.010155 |
| 5 | 0.53 | 0.672 | 19.16 | 17.96 | 38.26251 | 24.768 | 0.009887 |
| 6 | 0.53 | 0.672 | 19.69 | 18.49 | 38.26251 | 25.44 | 0.009632 |

| | | | | | | | |
|----|------|-------|-------|-------|----------|--------|----------|
| 7 | 0.53 | 0.672 | 20.22 | 19.02 | 38.26251 | 26.112 | 0.009391 |
| 8 | 0.53 | 0.672 | 20.75 | 19.55 | 38.26251 | 26.784 | 0.009161 |
| 9 | 0.53 | 0.672 | 21.28 | 20.08 | 38.26251 | 27.456 | 0.008942 |
| 10 | 0.53 | 0.672 | 21.81 | 20.61 | 38.26251 | 28.128 | 0.008733 |
| 11 | 0.53 | 0.672 | 22.34 | 21.14 | 38.26251 | 28.8 | 0.008534 |
| 12 | 0.53 | 0.672 | 22.87 | 21.67 | 38.26251 | 29.472 | 0.008344 |
| 13 | 0.53 | 0.672 | 23.4 | 22.2 | 38.26251 | 30.144 | 0.008162 |
| 14 | 0.53 | 0.672 | 23.93 | 22.73 | 38.26251 | 30.816 | 0.007988 |
| 15 | 0.53 | 0.672 | 24.46 | 23.26 | 38.26251 | 31.488 | 0.007821 |
| 16 | 0.53 | 0.672 | 24.99 | 23.79 | 38.26251 | 32.16 | 0.007661 |
| 17 | 0.53 | 0.672 | 25.52 | 24.32 | 38.26251 | 32.832 | 0.007507 |
| 18 | 0.53 | 0.672 | 26.05 | 24.85 | 38.26251 | 33.504 | 0.00736 |

Mainstand
Assessment

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|-----|------|------|-------|----------|--------|----------|
| 1 | 0.3 | 0.68 | 0.8 | -0.4 | 23.55944 | 6.05 | |
| 2 | 0.3 | 0.68 | 1.1 | -0.1 | 23.55944 | 6.738 | 0.170294 |
| 3 | 0.3 | 0.68 | 1.4 | 0.2 | 23.55944 | 7.426 | 0.155854 |
| 4 | 0.3 | 0.68 | 1.7 | 0.5 | 23.55944 | 8.114 | 0.143672 |
| 5 | 0.3 | 0.68 | 2 | 0.8 | 23.55944 | 8.802 | 0.133256 |
| 6 | 0.3 | 0.68 | 2.3 | 1.1 | 23.55944 | 9.49 | 0.124248 |
| 7 | 0.3 | 0.68 | 2.6 | 1.4 | 23.55944 | 10.178 | 0.116381 |
| 8 | 0.3 | 0.68 | 2.9 | 1.7 | 23.55944 | 10.866 | 0.109451 |
| 9 | 0.3 | 0.68 | 3.2 | 2 | 23.55944 | 11.554 | 0.1033 |
| 10 | 0.3 | 0.68 | 3.5 | 2.3 | 23.55944 | 12.242 | 0.097804 |
| 11 | 0.3 | 0.68 | 3.8 | 2.6 | 23.55944 | 12.93 | 0.092862 |
| 12 | 0.3 | 0.68 | 4.1 | 2.9 | 23.55944 | 13.618 | 0.088396 |
| 13 | 0.3 | 0.68 | 4.4 | 3.2 | 23.55944 | 14.306 | 0.08434 |
| 14 | 0.3 | 0.68 | 4.7 | 3.5 | 23.55944 | 14.994 | 0.08064 |
| 15 | 0.3 | 0.68 | 5 | 3.8 | 23.55944 | 15.682 | 0.077251 |
| 16 | 0.3 | 0.68 | 5.3 | 4.1 | 23.55944 | 16.37 | 0.074135 |
| 17 | 0.3 | 0.68 | 5.6 | 4.4 | 23.55944 | 17.058 | 0.071261 |
| 18 | 0.3 | 0.68 | 5.9 | 4.7 | 23.55944 | 17.746 | 0.068601 |
| 19 | 0.3 | 0.68 | 6.2 | 5 | 23.55944 | 18.434 | 0.066133 |
| 20 | 0.3 | 0.68 | 6.5 | 5.3 | 23.55944 | 19.122 | 0.063836 |
| 21 | 0.3 | 0.68 | 6.8 | 5.6 | 23.55944 | 19.81 | 0.061694 |
| 22 | 0.3 | 0.68 | 7.1 | 5.9 | 23.55944 | 20.498 | 0.05969 |
| 23 | 0.3 | 0.68 | 7.4 | 6.2 | 23.55944 | 21.186 | 0.057813 |
| 24 | 0.3 | 0.68 | 7.7 | 6.5 | 23.55944 | 21.874 | 0.05605 |
| 25 | 0.3 | 0.68 | 8 | 6.8 | 23.55944 | 22.562 | 0.054391 |
| 26 | 0.3 | 0.68 | 8.3 | 7.1 | 23.55944 | 23.25 | 0.052828 |
| 27 | 0.3 | 0.68 | 8.6 | 7.4 | 23.55944 | 23.938 | 0.051352 |
| 28 | 0.3 | 0.68 | 8.9 | 7.7 | 23.55944 | 24.626 | 0.049957 |
| 29 | 0.3 | 0.68 | 9.2 | 8 | 23.55944 | 25.314 | 0.048635 |
| 30 | 0.3 | 0.68 | 9.5 | 8.3 | 23.55944 | 26.002 | 0.047381 |
| 31 | 0.3 | 0.68 | 9.8 | 8.6 | 23.55944 | 26.69 | 0.04619 |
| 32 | 0.3 | 0.68 | 10.1 | 8.9 | 23.55944 | 27.378 | 0.045058 |
| 33 | 0.3 | 0.68 | 10.4 | 9.2 | 23.55944 | 28.066 | 0.04398 |
| 34 | 0.3 | 0.68 | 10.7 | 9.5 | 23.55944 | 28.754 | 0.042952 |
| 35 | 0.3 | 0.68 | 11 | 9.8 | 23.55944 | 29.442 | 0.041971 |
| 36 | 0.3 | 0.68 | 11.3 | 10.1 | 23.55944 | 30.13 | 0.041034 |

NEW POSITION with NEW EXECUTIVE BOXES

Exec level

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|------|------|-------|-------|----------|-------|----------|
| 1 | 0.55 | 0.78 | 13.2 | 12 | 35.18874 | 26.08 | |
| 2 | 0.55 | 0.78 | 13.75 | 12.55 | 35.18874 | 26.86 | 0.146454 |
| 3 | 0.55 | 0.78 | 14.3 | 13.1 | 35.18874 | 27.64 | 0.142435 |
| 4 | 0.55 | 0.78 | 14.85 | 13.65 | 35.18874 | 28.42 | 0.13863 |

Top Balcony reassessed following pitch displacement (4m)

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|-------|-------|--------|--------|----------|--------|----------|
| 1 | 0.528 | 0.672 | 17.04 | 15.84 | 38.15723 | 26.08 | |
| 2 | 0.528 | 0.672 | 17.568 | 16.368 | 38.15723 | 26.752 | 0.084574 |
| 3 | 0.528 | 0.672 | 18.096 | 16.896 | 38.15723 | 27.424 | 0.082551 |
| 4 | 0.528 | 0.672 | 18.624 | 17.424 | 38.15723 | 28.096 | 0.080623 |
| 5 | 0.528 | 0.672 | 19.152 | 17.952 | 38.15723 | 28.768 | 0.078783 |
| 6 | 0.528 | 0.672 | 19.68 | 18.48 | 38.15723 | 29.44 | 0.077024 |
| 7 | 0.528 | 0.672 | 20.208 | 19.008 | 38.15723 | 30.112 | 0.075343 |
| 8 | 0.528 | 0.672 | 20.736 | 19.536 | 38.15723 | 30.784 | 0.073733 |
| 9 | 0.528 | 0.672 | 21.264 | 20.064 | 38.15723 | 31.456 | 0.072191 |
| 10 | 0.528 | 0.672 | 21.792 | 20.592 | 38.15723 | 32.128 | 0.070712 |
| 11 | 0.528 | 0.672 | 22.32 | 21.12 | 38.15723 | 32.8 | 0.069293 |
| 12 | 0.528 | 0.672 | 22.848 | 21.648 | 38.15723 | 33.472 | 0.067929 |
| 13 | 0.528 | 0.672 | 23.376 | 22.176 | 38.15723 | 34.144 | 0.066618 |
| 14 | 0.528 | 0.672 | 23.904 | 22.704 | 38.15723 | 34.816 | 0.065356 |
| 15 | 0.528 | 0.672 | 24.432 | 23.232 | 38.15723 | 35.488 | 0.064142 |
| 16 | 0.528 | 0.672 | 24.96 | 23.76 | 38.15723 | 36.16 | 0.062971 |
| 17 | 0.528 | 0.672 | 25.488 | 24.288 | 38.15723 | 36.832 | 0.061843 |
| 18 | 0.528 | 0.672 | 26.016 | 24.816 | 38.15723 | 37.504 | 0.060754 |
| 19 | 0.528 | 0.672 | 26.544 | 25.344 | 38.15723 | 38.176 | 0.059703 |

Mainstand
Assessment
after pitch
movement

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|-------|------|-------|--------|----------|-------|----------|
| 1 | 0.303 | 0.68 | 0.8 | -0.4 | 24.01719 | 10.05 | |
| 2 | 0.303 | 0.68 | 1.103 | -0.097 | 24.01719 | 10.73 | 0.219207 |
| 3 | 0.303 | 0.68 | 1.406 | 0.206 | 24.01719 | 11.41 | 0.206878 |
| 4 | 0.303 | 0.68 | 1.709 | 0.509 | 24.01719 | 12.09 | 0.195861 |
| 5 | 0.303 | 0.68 | 2.012 | 0.812 | 24.01719 | 12.77 | 0.185959 |
| 6 | 0.303 | 0.68 | 2.315 | 1.115 | 24.01719 | 13.45 | 0.17701 |
| 7 | 0.303 | 0.68 | 2.618 | 1.418 | 24.01719 | 14.13 | 0.168883 |
| 8 | 0.303 | 0.68 | 2.921 | 1.721 | 24.01719 | 14.81 | 0.161469 |
| 9 | 0.303 | 0.68 | 3.224 | 2.024 | 24.01719 | 15.49 | 0.154678 |
| 10 | 0.303 | 0.68 | 3.527 | 2.327 | 24.01719 | 16.17 | 0.148436 |
| 11 | 0.303 | 0.68 | 3.83 | 2.63 | 24.01719 | 16.85 | 0.142678 |

| | | | | | | | |
|----|-------|------|--------|--------|----------|-------|----------|
| 12 | 0.303 | 0.68 | 4.133 | 2.933 | 24.01719 | 17.53 | 0.13735 |
| 13 | 0.303 | 0.68 | 4.436 | 3.236 | 24.01719 | 18.21 | 0.132406 |
| 14 | 0.303 | 0.68 | 4.739 | 3.539 | 24.01719 | 18.89 | 0.127805 |
| 15 | 0.303 | 0.68 | 5.042 | 3.842 | 24.01719 | 19.57 | 0.123514 |
| 16 | 0.303 | 0.68 | 5.345 | 4.145 | 24.01719 | 20.25 | 0.119501 |
| 17 | 0.303 | 0.68 | 5.648 | 4.448 | 24.01719 | 20.93 | 0.11574 |
| 18 | 0.303 | 0.68 | 5.951 | 4.751 | 24.01719 | 21.61 | 0.11221 |
| 19 | 0.303 | 0.68 | 6.254 | 5.054 | 24.01719 | 22.29 | 0.108888 |
| 20 | 0.303 | 0.68 | 6.557 | 5.357 | 24.01719 | 22.97 | 0.105757 |
| 21 | 0.303 | 0.68 | 6.86 | 5.66 | 24.01719 | 23.65 | 0.102801 |
| 22 | 0.303 | 0.68 | 7.163 | 5.963 | 24.01719 | 24.33 | 0.100006 |
| 23 | 0.303 | 0.68 | 7.466 | 6.266 | 24.01719 | 25.01 | 0.097359 |
| 24 | 0.303 | 0.68 | 7.769 | 6.569 | 24.01719 | 25.69 | 0.094848 |
| 25 | 0.303 | 0.68 | 8.072 | 6.872 | 24.01719 | 26.37 | 0.092464 |
| 26 | 0.303 | 0.68 | 8.375 | 7.175 | 24.01719 | 27.05 | 0.090197 |
| 27 | 0.303 | 0.68 | 8.678 | 7.478 | 24.01719 | 27.73 | 0.088038 |
| 28 | 0.303 | 0.68 | 8.981 | 7.781 | 24.01719 | 28.41 | 0.08598 |
| 29 | 0.303 | 0.68 | 9.284 | 8.084 | 24.01719 | 29.09 | 0.084016 |
| 30 | 0.303 | 0.68 | 9.587 | 8.387 | 24.01719 | 29.77 | 0.08214 |
| 31 | 0.303 | 0.68 | 9.89 | 8.69 | 24.01719 | 30.45 | 0.080345 |
| 32 | 0.303 | 0.68 | 10.193 | 8.993 | 24.01719 | 31.13 | 0.078628 |
| 33 | 0.303 | 0.68 | 10.496 | 9.296 | 24.01719 | 31.81 | 0.076982 |
| 34 | 0.303 | 0.68 | 10.799 | 9.599 | 24.01719 | 32.49 | 0.075404 |
| 35 | 0.303 | 0.68 | 11.102 | 9.902 | 24.01719 | 33.17 | 0.073889 |
| 36 | 0.303 | 0.68 | 11.405 | 10.205 | 24.01719 | 33.85 | 0.072434 |

NEW BULLENS ROAD STAND Calculated C-Values

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|------|------|------|-------|----------|-------|----------|
| 1 | 0.18 | 0.76 | 0.8 | -0.4 | 13.32453 | 9.5 | |
| 2 | 0.18 | 0.76 | 0.98 | -0.22 | 13.32453 | 10.26 | 0.1 |
| 3 | 0.18 | 0.76 | 1.16 | -0.04 | 13.32453 | 11.02 | 0.093548 |
| 4 | 0.18 | 0.76 | 1.34 | 0.14 | 13.32453 | 11.78 | 0.087879 |
| 5 | 0.18 | 0.76 | 1.52 | 0.32 | 13.32453 | 12.54 | 0.082857 |
| 6 | 0.18 | 0.76 | 1.7 | 0.5 | 13.32453 | 13.3 | 0.078378 |
| 7 | 0.18 | 0.76 | 1.88 | 0.68 | 13.32453 | 14.06 | 0.074359 |
| 8 | 0.27 | 0.76 | 2.06 | 0.86 | 19.55825 | 14.82 | 0.070732 |
| 9 | 0.27 | 0.76 | 2.33 | 1.13 | 19.55825 | 15.58 | 0.14907 |
| 10 | 0.27 | 0.76 | 2.6 | 1.4 | 19.55825 | 16.34 | 0.142444 |
| 11 | 0.27 | 0.76 | 2.87 | 1.67 | 19.55825 | 17.1 | 0.136383 |
| 12 | 0.27 | 0.76 | 3.14 | 1.94 | 19.55825 | 17.86 | 0.130816 |
| 13 | 0.27 | 0.76 | 3.41 | 2.21 | 19.55825 | 18.62 | 0.125686 |
| 14 | 0.27 | 0.76 | 3.68 | 2.48 | 19.55825 | 19.38 | 0.120943 |
| 15 | 0.27 | 0.76 | 3.95 | 2.75 | 19.55825 | 20.14 | 0.116545 |
| 16 | 0.27 | 0.76 | 4.22 | 3.02 | 19.55825 | 20.9 | 0.112456 |
| 17 | 0.27 | 0.76 | 4.49 | 3.29 | 19.55825 | 21.66 | 0.108644 |
| 18 | 0.27 | 0.76 | 4.76 | 3.56 | 19.55825 | 22.42 | 0.105082 |
| 19 | 0.27 | 0.76 | 5.03 | 3.83 | 19.55825 | 23.18 | 0.101746 |
| 20 | 0.27 | 0.76 | 5.3 | 4.1 | 19.55825 | 23.94 | 0.098615 |
| 21 | 0.27 | 0.76 | 5.57 | 4.37 | 19.55825 | 24.7 | 0.095672 |
| 22 | 0.27 | 0.76 | 5.84 | 4.64 | 19.55825 | 25.46 | 0.092899 |
| 23 | 0.6 | 0.76 | 6.11 | 4.91 | 38.29016 | 26.22 | 0.090282 |
| 24 | 0.35 | 0.76 | 6.71 | 5.51 | 24.72731 | 26.98 | 0.399726 |
| 25 | 0.35 | 0.76 | 7.06 | 5.86 | 24.72731 | 27.74 | 0.1524 |
| 26 | 0.35 | 0.76 | 7.41 | 6.21 | 24.72731 | 28.5 | 0.148442 |

| | | | | | | | |
|----|------|------|------|------|----------|-------|----------|
| 27 | 0.35 | 0.76 | 7.76 | 6.56 | 24.72731 | 29.26 | 0.144684 |
| 28 | 0.35 | 0.76 | 8.11 | 6.91 | 24.72731 | 30.02 | 0.141111 |

Second Tier

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|------|------|-------|-------|----------|-------|----------|
| 1 | 0.51 | 0.76 | 11.2 | 10 | 33.86369 | 21.2 | |
| 2 | 0.51 | 0.76 | 11.71 | 10.51 | 33.86369 | 21.96 | 0.101232 |
| 3 | 0.51 | 0.76 | 12.22 | 11.02 | 33.86369 | 22.72 | 0.097956 |
| 4 | 0.51 | 0.76 | 12.73 | 11.53 | 33.86369 | 23.48 | 0.094884 |
| 5 | 0.51 | 0.76 | 13.24 | 12.04 | 33.86369 | 24.24 | 0.092 |
| 6 | 0.51 | 0.76 | 13.75 | 12.55 | 33.86369 | 25 | 0.089286 |
| 7 | 0.51 | 0.76 | 14.26 | 13.06 | 33.86369 | 25.76 | 0.086727 |
| 8 | 0.51 | 0.76 | 14.77 | 13.57 | 33.86369 | 26.52 | 0.084311 |
| 9 | 0.51 | 0.76 | 15.28 | 14.08 | 33.86369 | 27.28 | 0.082026 |
| 10 | 0.51 | 0.76 | 15.79 | 14.59 | 33.86369 | 28.04 | 0.079861 |
| 11 | 0.51 | 0.76 | 16.3 | 15.1 | 33.86369 | 28.8 | 0.077808 |
| 12 | 0.51 | 0.76 | 16.81 | 15.61 | 33.86369 | 29.56 | 0.075858 |
| 13 | 0.51 | 0.76 | 17.32 | 16.12 | 33.86369 | 30.32 | 0.074003 |
| 14 | 0.51 | 0.76 | 17.83 | 16.63 | 33.86369 | 31.08 | 0.072236 |
| 15 | 0.51 | 0.76 | 18.34 | 17.14 | 33.86369 | 31.84 | 0.070552 |
| 16 | 0.51 | 0.76 | 18.85 | 17.65 | 33.86369 | 32.6 | 0.068945 |
| 17 | 0.51 | 0.76 | 19.36 | 18.16 | 33.86369 | 33.36 | 0.067409 |
| 18 | 0.51 | 0.76 | 19.87 | 18.67 | 33.86369 | 34.12 | 0.06594 |
| 19 | 0.51 | 0.76 | 20.38 | 19.18 | 33.86369 | 34.88 | 0.064534 |
| 20 | 0.51 | 0.76 | 20.89 | 19.69 | 33.86369 | 35.64 | 0.063187 |
| 21 | 0.51 | 0.76 | 21.4 | 20.2 | 33.86369 | 36.4 | 0.061895 |

NEW PARK END AND GWLADYS STREET END STANDS

Calculated C-values

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|------|------|------|-------|----------|-------|----------|
| 1 | 0.18 | 0.76 | 0.8 | -0.4 | 13.32453 | 12.3 | |
| 2 | 0.18 | 0.76 | 0.98 | -0.22 | 13.32453 | 13.06 | 0.116208 |
| 3 | 0.18 | 0.76 | 1.16 | -0.04 | 13.32453 | 13.82 | 0.110151 |
| 4 | 0.18 | 0.76 | 1.34 | 0.14 | 13.32453 | 14.58 | 0.104694 |
| 5 | 0.18 | 0.76 | 1.52 | 0.32 | 13.32453 | 15.34 | 0.099752 |
| 6 | 0.18 | 0.76 | 1.7 | 0.5 | 13.32453 | 16.1 | 0.095255 |
| 7 | 0.18 | 0.76 | 1.88 | 0.68 | 13.32453 | 16.86 | 0.091146 |
| 8 | 0.25 | 0.76 | 2.06 | 0.86 | 18.20848 | 17.62 | 0.087378 |
| 9 | 0.25 | 0.76 | 2.31 | 1.11 | 18.20848 | 18.38 | 0.148349 |
| 10 | 0.25 | 0.76 | 2.56 | 1.36 | 18.20848 | 19.14 | 0.142683 |
| 11 | 0.25 | 0.76 | 2.81 | 1.61 | 18.20848 | 19.9 | 0.137435 |
| 12 | 0.25 | 0.76 | 3.06 | 1.86 | 18.20848 | 20.66 | 0.132558 |
| 13 | 0.25 | 0.76 | 3.31 | 2.11 | 18.20848 | 21.42 | 0.128016 |
| 14 | 0.25 | 0.76 | 3.56 | 2.36 | 18.20848 | 22.18 | 0.123775 |
| 15 | 0.25 | 0.76 | 3.81 | 2.61 | 18.20848 | 22.94 | 0.119806 |
| 16 | 0.25 | 0.76 | 4.06 | 2.86 | 18.20848 | 23.7 | 0.116083 |
| 17 | 0.25 | 0.76 | 4.31 | 3.11 | 18.20848 | 24.46 | 0.112585 |
| 18 | 0.25 | 0.76 | 4.56 | 3.36 | 18.20848 | 25.22 | 0.109292 |
| 19 | 0.25 | 0.76 | 4.81 | 3.61 | 18.20848 | 25.98 | 0.106185 |
| 20 | 0.25 | 0.76 | 5.06 | 3.86 | 18.20848 | 26.74 | 0.103251 |
| 21 | 0.25 | 0.76 | 5.31 | 4.11 | 18.20848 | 27.5 | 0.100474 |
| 22 | 0.25 | 0.76 | 5.56 | 4.36 | 18.20848 | 28.26 | 0.097843 |
| 23 | 0.25 | 0.76 | 5.81 | 4.61 | 18.20848 | 29.02 | 0.095346 |
| 24 | 0.25 | 0.76 | 6.06 | 4.86 | 18.20848 | 29.78 | 0.092973 |
| 25 | 0.25 | 0.76 | 6.31 | 5.11 | 18.20848 | 30.54 | 0.090716 |

| | | | | | | | |
|----|------|------|------|------|----------|-------|----------|
| 26 | 0.25 | 0.76 | 6.56 | 5.36 | 18.20848 | 31.3 | 0.088565 |
| 27 | 0.25 | 0.76 | 6.81 | 5.61 | 18.20848 | 32.06 | 0.086514 |
| 28 | 0.25 | 0.76 | 7.06 | 5.86 | 18.20848 | 32.82 | 0.084556 |
| 29 | 0.25 | 0.76 | 7.31 | 6.11 | 18.20848 | 33.58 | 0.082685 |
| 30 | 0.25 | 0.76 | 7.56 | 6.36 | 18.20848 | 34.34 | 0.080895 |
| 31 | 0.25 | 0.76 | 7.81 | 6.61 | 18.20848 | 35.1 | 0.07918 |
| 32 | 0.25 | 0.76 | 8.06 | 6.86 | 18.20848 | 35.86 | 0.077537 |
| 33 | 0.25 | 0.76 | 8.31 | 7.11 | 18.20848 | 36.62 | 0.07596 |
| 34 | 0.25 | 0.76 | 8.56 | 7.36 | 18.20848 | 37.38 | 0.074447 |

Second Tier

| Row | N | T | R | Stand | Angle | D | C-value |
|-----|------|------|-------|-------|----------|-------|----------|
| 1 | 0.51 | 0.76 | 10 | 8.8 | 33.86369 | 22 | |
| 2 | 0.51 | 0.76 | 10.51 | 9.31 | 33.86369 | 22.76 | 0.153912 |
| 3 | 0.51 | 0.76 | 11.02 | 9.82 | 33.86369 | 23.52 | 0.149094 |
| 4 | 0.51 | 0.76 | 11.53 | 10.33 | 33.86369 | 24.28 | 0.144569 |
| 5 | 0.51 | 0.76 | 12.04 | 10.84 | 33.86369 | 25.04 | 0.14031 |
| 6 | 0.51 | 0.76 | 12.55 | 11.35 | 33.86369 | 25.8 | 0.136295 |
| 7 | 0.51 | 0.76 | 13.06 | 11.86 | 33.86369 | 26.56 | 0.132504 |
| 8 | 0.51 | 0.76 | 13.57 | 12.37 | 33.86369 | 27.32 | 0.128917 |
| 9 | 0.51 | 0.76 | 14.08 | 12.88 | 33.86369 | 28.08 | 0.12552 |
| 10 | 0.51 | 0.76 | 14.59 | 13.39 | 33.86369 | 28.84 | 0.122297 |
| 11 | 0.51 | 0.76 | 15.1 | 13.9 | 33.86369 | 29.6 | 0.119236 |
| 12 | 0.51 | 0.76 | 15.61 | 14.41 | 33.86369 | 30.36 | 0.116324 |
| 13 | 0.51 | 0.76 | 16.12 | 14.92 | 33.86369 | 31.12 | 0.113551 |
| 14 | 0.51 | 0.76 | 16.63 | 15.43 | 33.86369 | 31.88 | 0.110907 |
| 15 | 0.51 | 0.76 | 17.14 | 15.94 | 33.86369 | 32.64 | 0.108383 |
| 16 | 0.51 | 0.76 | 17.65 | 16.45 | 33.86369 | 33.4 | 0.105972 |
| 17 | 0.51 | 0.76 | 18.16 | 16.96 | 33.86369 | 34.16 | 0.103666 |
| 18 | 0.51 | 0.76 | 18.67 | 17.47 | 33.86369 | 34.92 | 0.101457 |
| 19 | 0.51 | 0.76 | 19.18 | 17.98 | 33.86369 | 35.68 | 0.099341 |
| 20 | 0.51 | 0.76 | 19.69 | 18.49 | 33.86369 | 36.44 | 0.097312 |
| 21 | 0.51 | 0.76 | 20.2 | 19 | 33.86369 | 37.2 | 0.095364 |
| 22 | 0.51 | 0.76 | 20.71 | 19.51 | 33.86369 | 37.96 | 0.093492 |
| 23 | 0.51 | 0.76 | 21.22 | 20.02 | 33.86369 | 38.72 | 0.091692 |
| 24 | 0.51 | 0.76 | 21.73 | 20.53 | 33.86369 | 39.48 | 0.08996 |
| 25 | 0.51 | 0.76 | 22.24 | 21.04 | 33.86369 | 40.24 | 0.088293 |
| 26 | 0.51 | 0.76 | 22.75 | 21.55 | 33.86369 | 41 | 0.086686 |
| 27 | 0.51 | 0.76 | 23.26 | 22.06 | 33.86369 | 41.76 | 0.085136 |
| 28 | 0.51 | 0.76 | 23.77 | 22.57 | 33.86369 | 42.52 | 0.083641 |
| 29 | 0.51 | 0.76 | 24.28 | 23.08 | 33.86369 | 43.28 | 0.082198 |
| 30 | 0.51 | 0.76 | 24.79 | 23.59 | 33.86369 | 44.04 | 0.080804 |
| 31 | 0.51 | 0.76 | 25.3 | 24.1 | 33.86369 | 44.8 | 0.079456 |
| 32 | 0.51 | 0.76 | 25.81 | 24.61 | 33.86369 | 45.56 | 0.078152 |
| 33 | 0.51 | 0.76 | 26.32 | 25.12 | 33.86369 | 46.32 | 0.07689 |
| 34 | 0.51 | 0.76 | 26.83 | 25.63 | 33.86369 | 47.08 | 0.075669 |
| 35 | 0.51 | 0.76 | 27.34 | 26.14 | 33.86369 | 47.84 | 0.074486 |
| 36 | 0.51 | 0.76 | 27.85 | 26.65 | 33.86369 | 48.6 | 0.073339 |
| 37 | 0.51 | 0.76 | 28.36 | 27.16 | 33.86369 | 49.36 | 0.072227 |

Acknowledgements:

Shaun Weaver: 3-D CAD Modelling and Rendering.